

**Rates of Return to University Education  
in Canada in 2000<sup>1</sup>**

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## **Abstract**

This paper studies the private and total rates of return to university education in Canada, by level of education, by field of study for the bachelor level, and by sex. The method used is based on the calculation of the internal rate of return and is applied to the data from the Canadian Census of 2001.

The results indicate that rates of return to university education vary by sex, by level of education, and by field of study. First of all, the highest total and private rates of return to education in 2000 resulted from obtaining a bachelor degree. Second, both the private and total rates of return of women are higher than those of men. Third, rates of return tend to decline by level of education attained. Finally, the highest rate of return by field of study for the bachelor level is in engineering and the lowest is in the humanities. The results are consistent with those of Vaillancourt (1995) and Vaillancourt and Bourdeau-Primeau (2002).

## **1. Introduction**

At various stages of their lives, rational individuals have an opportunity to choose to pursue advance studies or to work after completing formal education. A high school graduate also thinks about which field he or she will choose to study after deciding to pursue post secondary education. If financial benefits provided by education are greater than costs, the students may decide to invest in education because they have higher probability of earning higher income in the future.

Governments make decisions whether or not to invest more capital in education that depend partly on the percentage in which tax revenues collected on the additional income of the most highly educated will be greater than the costs spent on education.

In addition to those financial considerations, there are other unmeasured benefits and costs that rational individuals and governments consider. For example, individuals care about their capacity enhancement due to university education.

Governments consider the improvement of productivity and the quality of the society as a whole. Becker (1962) and Schultz (1963) explained that education enhances productivity. "Since it represents an accumulation of knowledge, human capital is a source of innovation and one of the main causes of economic growth. Improved knowledge and skills also enable workers to perceive technological change more clearly and to adapt to it more effectively."<sup>2</sup> Education makes a vital contribution to the quality and well-being of the Canadian people.

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<sup>2</sup>Appleby, John, Maxime Fougère, and Manon Rouleau, (2002), page 1

Those are important to determine investment in education. However, there are limitations to the analysis of the unmeasured benefits and costs. Technically it is difficult to estimate their partial effect. While the financial aspect does not cover everything, it is still an important factor and it is worth doing the exercise to calculate it. So I focus in this study on the rates of return to education by comparing earnings profiles of individual with various levels of education.

There are several studies in this field that have been carried out in Canada. In some of them, such as Vaillancourt (1995), Vaillancourt and Bourdeau-Primeau (2002) and Dodge and Stager (1972), internal rates of return (IRR) to education are calculated using earnings profiles by level of education and by field of study. In other studies, such as Berger (1988), and Finnie (1995), they focus on analysis of earning differences by field of study, of effects of earnings differences by sex, and on trend analysis of rates of return to education over time.

The data sources also vary. Some studies, such as Vaillancourt (1995) and Vaillancourt and Bourdeau-Primeau (2002), used data from the microdata files of the Canadian censuses to generate findings. Finnie (1999) evaluated earning differences by field of study based on the databases of the National Graduates Survey of Canadian College and University. A third group of studies, such as Appleby, Fougère, and Rouleau (2002), found results based on data from the Survey of Consumer Finance (SCF).

This paper reports and analyzes the empirical findings of the rates of return to university education by field of study and by level of education based on the Canadian census of 2001, using a methodology similar to Vaillancourt (1995) and to Vaillancourt and Bourdeau-Primeau (2002). It focuses on the study of the private and total rates of return to education and analyzes the rates of return from the standpoint of individuals and society as a whole.

The paper is divided into six parts. In Part 2, results of the two studies just mentioned by Vaillancourt and Bourdeau-Primeau are reviewed. I also provide the definitions of the private and total rates of return to education. In Part 3, the methodology and data to estimate the rates of return to education are introduced. In Part 4, the empirical findings based on the 2001 Canadian census are presented and analyzed. In Part 5, earnings profiles by age are presented. The final part summarizes the findings.

## **2. Studies by Vaillancourt and Bourdeau-Primeau**

In his 1995 study, Vaillancourt evaluated the private and total rates of return to education in Canada for 1985 using the internal rate of return method, with the 1986 Canadian census individual microdata, for level of education by gender and by field of study for the bachelor level. The file includes a two per cent sample from the 1986 census. Individuals are allocated to one of eight levels of education, including elementary, secondary, certificate, college, bachelor,

master, health, and PHD. Individuals are also allocated to one of seven fields of study, including education, humanities, social sciences, commerce, pure sciences, engineering, and health for the bachelor education.

Vaillancourt and Bourdeau-Primeau (2002) estimated the private and total rates of return to education in Canada for 1990 and 1995 using the same method as Vaillancourt (1995), with the 1991 and 1996 Canadian censuses individual microdata. Those files include a 3.0 per cent sample from the 1991 census and a 2.8 per cent sample from the 1996 census. The authors assigned individuals to one of three levels of university education, including bachelor, master, and PHD. They use the same method as Vaillancourt (1995) to separate fields of study.

There are three steps to calculate the rates of return in Vaillancourt and Bourdeau-Primeau (2002). First of all, the authors estimate earnings profiles equations by level of education with ordinary least squares.

$$\ln(\text{earnings}) = B_0 + B_1 * \text{Age} + B_2 * \text{Age}^2 \quad (1)$$

The authors use a semi-logarithmic equation to relate earnings to age and age square to estimate age-earnings profiles for each level of education.

When they consider the fields of study, they add the terms in the brackets of equation (2) below, which are dummy variables that modify the intercept and the slope.

$$\ln(\text{earnings}) = B_0 + B_1 \text{ Age} + B_2 \text{ Age}^2 + \left[ \sum_{i=1}^7 B_{i3} \text{ Fields} + \sum_{i=2}^7 B_{i4} \text{ Fields} \times \text{Age} \right] \quad (2)$$

They then calculate the earnings by level of education and by field of study for the bachelor level using the earnings profiles equation (1) and (2), respectively.

In their second step, they calculate the costs of education: the up-front cost including direct costs, and foregone earnings. Finally, they use the internal rate of return function to obtain the IRR.

$$0 = \sum_{i=1}^N \frac{(A_i - B_i)}{(1+r)^i} - C, \quad (3)$$

where  $C$  represents the direct and indirect costs of earning a post-secondary degree or diploma,  $A$  and  $B$  are the net benefits from After and Before possessing a post-secondary degree or diploma,  $r$  is the discount rate or internal rate of return,  $i$  starts at the anticipated age at the end of post-secondary studies, and  $N$  is the duration of working life.

Before introducing the authors' findings, I provide the definition of the social (or total)<sup>3</sup> and private rate of return to education in Canada. The rates of return to education are quite different from different perspectives. Reference may be made to two concepts of rate of return to education: social and private. Appleby, Fougère, and Rouleau (2002) provide the following definitions:

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<sup>3</sup> Social and total rate of return to education are the same concepts. Vaillancourt and Bourdeau-Primeau use "total" rates of return, while other authors, such as Appleby, Fougère, and Rouleau, use "social" rates of return.

The *social* rate of return serves as a point of reference for government authorities in determining whether it is financially cost effective, from the standpoint of society as a whole, to promote access to a given level of education. [...] It is estimated on the basis of the additional employment income (before taxes) of the most highly educated. Direct costs represent the total value of wages paid to teachers and the maintenance expenses of establishments as well as the cost of capital. Indirect costs are the total value of goods and services not produced. They are represented by the total value of gross income not received by full-time students.

[...]

The *private* rate of returns pertains to an agent in particular. [...] The benefits associated with one level of education rather than another represent the difference between the respective incomes anticipated during the period of working life in the labour market. Direct costs comprise tuition fees and other expenses paid, in particular to purchase books. Indirect costs do not represent an additional sum that must be paid but are equivalent to employment income not received during the training period. Financial assistance paid to students partially offsets the value of disbursements.

Source: Appleby, Fougère, and Rouleau (2002), Pages 4-5

Vaillancourt and Bourdeau-Primeau's findings may be summarized in four points.

First of all, the highest total and private rates of return to education for 1985 resulted from obtaining a high school diploma. The highest total rates are 11.9 per cent for men and 9.1 per cent for women and the highest private rates are 33.4 per cent for men and 38.5 per cent for women in 1985. The highest total and private rates of return to university education for 1990 and 1995 resulted from obtaining a bachelor degree. The highest total rates are 8 per cent for men and 8 per cent for women in 1990, and 10 per cent for men and 10 per cent for women in 1995. The highest private rates are 16 per cent for men and 19 per cent for women in 1990, and 17 per cent for men and 20 per cent for women in 1995.

Second, the private rates of return of women are higher than those of men. Rates of return for men with bachelor's degrees are 8.3 per cent in 1985, 16 per cent in 1990, and 17 per cent in 1995, while rates for women are very similar for those three years, 18.8 per cent, 19 per cent, and 20 per cent, respectively. Third, rates of return decrease by level of education attained, which follows from the theory of diminishing returns. An exception is that the total and private rates of return to PhD degree for women are higher than those to master degree in 1985 and 1995. Fourth, the rates of return to the bachelor level differ by field of study, the highest returns for men being in engineering and the lowest being in the humanities. The authors mention that this result is due to the fact that mathematics and science are difficult topics to learn, or are perceived to be so by students.

### **3. Methodology for the rate of return to education**

The methodology in this paper is developed from Vaillancourt and Bourdeau-Primeau's work (2002). The method is based on the financial aspects of the cost-benefit of education already shown in equation (3) above. The breakeven point or internal rate of return is calculated so that the sum of present values of benefits is equal to the sum of present values of costs.

This paper uses the Canadian census of 2001 to replicate Vaillancourt and Bourdeau-Primeau's study. The *2001 Census Public Use Microdata File (PUMF)*

on *Individuals* contains data based on a 2.7 per cent sample of the population enumerated in the census.<sup>4</sup> I choose eight variables from PUMF: age, sex, weeks worked in 2000, highest level of schooling, highest degree, certificate or diploma, major field of study, wages and salaries and self-employment income. My study focus on the full-year employees, so I select the individual employed forty-eight weeks or more in 2000. The major field of study classification structure consists of 18 major categories. Similarly to Vaillancourt (1995) and Vaillancourt and Bourdeau-Primeau (2002), I allocate individuals to one of seven fields of study, including education, humanities, social sciences, commerce, pure sciences, engineering, and health sciences for the bachelor education. Individuals are allocated to one of five levels of education based on the highest level of schooling and the highest degree held for the university level, shown in Table 1. In this paper, the purpose of keeping high school level in Table 1 is to calculate the foregone costs for bachelor level. I ignore the study of health degree and only focus on the study of three levels of the university education, including bachelor, master and PhD degree.

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<sup>4</sup> 2001 Canadian census Microdata codebook

**Table 1. Definitions of the levels of schooling and fields of study from 2001 census codebook**

levels of schooling	Comments	DGREEP	HLOSP
High school certificate		2	4
Bachelor`s degree		6	11
Health degree		8	11
Master`s degree		9	13
PH D		10	14
<b>Fields of Study (University degrees)</b>			
Education	Educational, recreational and counselling services	1	
Humanities	Fine and applied Arts, Humanities and related field	2 or 3	
Social Sciences		4	
Commerce		5 to 9	
Pure Sciences	Agricultural, biological, nutritional, food, Pure and Mathematical Sciences	10 or 18	
Engineering		11 to 15	
Health Sciences	Nursing, Health Professions and Sciences	16 or 17	
Others		19	

Source: 2001 Census Codebook

Earnings are estimated using two earning profiles equations, the first one is a semi-logarithmic equation to relate earnings to age by level of education, and another one is a semi-logarithmic equation relate earnings to age and field of study.

The following equation is used for estimating earnings by level of education:

$$\ln(\text{earning}) = B_0 + B_1 * \text{Age} + B_2 * \text{Age}^2 \quad (4)$$

The following equation is used for estimating earnings by field of study for the bachelor level:

$$\ln(\text{earning}) = B_0 + B_1 * \text{Age} + B_2 * \text{Age}^2 + \left[ \sum_{i=1}^8 B_{i3} * \text{Fields} + \sum_{i=1}^8 B_{i4} * \text{Fields} * \text{Age} \right] \quad (5)$$

The earnings include two components: wages and salaries and self-employment income. Only individuals with positive earnings are chosen, due to the model limitation that the natural logarithm of earnings must be greater than zero. The choice leads to the exclusion of individuals who have no income. This may lead to an overestimation of the rates of return to education.

Similarly to Vaillancourt and Bourdeau-Primeau, gross earnings (before income taxes) and net earnings (after income tax) are used respectively to calculate the total and private rates of returns. I estimate the coefficients of the earnings equations (Equation 4 and Equation 5) using the Canadian census of 2001 for gross earnings. The regression results used in the study are shown in Appendix Tables A-1 and A-2.

Assumptions are made about age at completing three levels of university education and about age at retirement. Students graduate from high school and begin bachelor studies at 18 years old, and they graduate from their bachelor at 22, from their master at 24, and from their PhD at 28 years old. They start to work until they retire at 62 years old, which is the same age for all the workers. The various gross earnings for each age from graduation to retirement are then

calculated on an annual basis using the relevant equations and coefficients of Appendix Tables A-1 and A-2. This procedure is the same as the one of Vaillancourt and Bourdeau-Primeau.

The after-tax income of individual, who are assumed to claim the employment insurance(EI), the Canada or Quebec Pension Plan (CPP/QPP) credit and the allowable registered retirement savings plan (RRSP), is equal to gross income minus personal income tax, EI, CPP and RRSP. Not all people contribute 100% of the allowed deduction of 18 per cent of earning to their RRSP. Statistics Canada provides data about RRSP. I select the total RRSP room, total unused RRSP and total new RRSP in CANSIM Table 111-0040<sup>5</sup> to estimate the annual contribution to RRSP account. According to the footnote of Table 111-0040, total RRSP room is equal to the sum of total unused RRSP and total new RRSP. I then calculate the annual contribution that is equal to the total RRSP room of the previous year plus total new RRSP minus the total RRSP room of the present year. I also use total employment income in CANSIM Table 111-0014.<sup>6</sup> Finally, I calculate the percentage of taxable income contributed to RRSP using annual RRSP contribution divided by total employment income. The six contribution rates from 2000 to 2005 are calculated using the above method in the Third column of Table 2. I also used the articles about RRSP contributions, "*Registered retirement savings plan contributions*" published in The Dailies of

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<sup>5</sup> Registered Retirement Savings Plan (RRSP) room, annual,

<sup>6</sup> Family characteristics, by family type and sources of income, annual  
<http://estat.statcan.ca/cgi-win/CNSMCGI.EXE>

Statistics Canada of November 28, 2001<sup>7</sup>, November 19, 2002<sup>8</sup>, October 23, 2003<sup>9</sup>, November 2, 2004<sup>10</sup>, October 26, 2005<sup>11</sup>, and November 22, 2006<sup>12</sup>.

The annual contributions to RRSP from The Daily are shown in the 5<sup>th</sup> column of the Table 2. Both rates are quite consistent. In this paper, I assume that the average of the RRSP contribution rate from 2000 to 2005, i.e. 5.04%, represents the lifetime RRSP contribution rates.

**Table 2 RRSP Annual Contribution Rate**

Year	Annual Contribution to RRSP(*1000) <sup>1</sup>	Contribution rate <sup>2</sup>	Total employment income (*1000) <sup>3</sup>	Annual Contribution to RRSP (Billion) <sup>4</sup>	Contribution rate <sup>5</sup>
2000	29,008,881	5.74%	505,502,178	29.3	5.80%
2001	28,915,787	5.37%	538,251,346	28.4	5.28%
2002	27,268,291	4.95%	550,562,134	27.1	4.92%
2003	27,255,455	4.77%	571,927,467	27.6	4.83%
2004	29,070,981	4.82%	603,091,295	28.8	4.78%
2005	29,352,724	4.60%	637,652,144	30.5	4.78%
Ave		5.04%			5.06%

Note: 1. Annual contribution to RRSP calculated from CANSIM Table 111-0040  
 2. Contribution rate calculated (annual contribution to RRSP / total employment income)  
 3. Total employment income obtained from CANSIM Table 111-0014  
 4. Annual contribution to RRSP obtained from the articles, *Registered retirement savings plan contributions*, in The Daily of Statistics Canada  
 5. Calculated contribution rate ( column 5th /column 4Th)

Similarly to Vaillancourt and Bourdeau-Primeau, person income taxes are calculated by the federal income tax system in 2000 and the Ontario tax system in 2000, as representing the provincial rates. The federal tax, provincial tax, EI contribution, CPP contribution, RRSP contribution rate, and minimum and maximum taxable earnings are shown in Table 3. I also assume that the tax

<sup>7</sup> <http://www.statcan.ca/Daily/English/011128/d011128f.htm>  
<sup>8</sup> <http://www.statcan.ca/Daily/English/021119/d021119b.htm>  
<sup>9</sup> <http://www.statcan.ca/Daily/English/031023/d031023b.htm>  
<sup>10</sup> <http://www.statcan.ca/Daily/English/041102/d041102b.htm>  
<sup>11</sup> <http://www.statcan.ca/Daily/English/051026/d051026b.htm>  
<sup>12</sup> <http://www.statcan.ca/Daily/English/061122/d061122f.htm>

system of year 2000 applies for year at graduation to year at retirement. Of course, it is unlikely that the tax rates will remain the same for about 40 years; however, the methodology consists of using single-year (cross-sectional) results to represent lifetime employment income. Finally, I calculate the differences in wages between after and before education. Then the internal rate of return is calculated so that the sum of present values of benefits is equal to the sum of present values of costs.

**Table 3 : Tax Parameters Used in the Simulation of Private Income**

Parameter	2000
Federal tax rates	
First tax bracket: 17% rate	\$0-\$30,004 taxable income
Second tax bracket: 25% rate	\$30,005-\$60,009 taxable income
Third tax bracket: 29% rate	More than \$60,010 taxable income
Ontario tax rate	
First tax bracket: 6.37% rate	\$0-\$30,004 taxable income
Second tax bracket: 9.62% rate	\$30,005-\$60,009 taxable income
Third tax bracket: 11.16% rate	More than \$60,010 taxable income
EI contribution rate	2.40%
EI maximum annual insurable earnings	\$39,000
CPP\ QPP contribution rate	3.90%
Basic Exemption	\$3,500
CPP\ QPP maximum taxable earnings(annual)	\$37,600
RRSP contribution rate	5%

Source: Canada Revenue Agency 2000<sup>13</sup>

In the above part, I have already discussed the benefits from higher level of education. Now I start to calculate the costs of education. The private costs are composed of direct costs paid by students, including tuition, out-of-pocket

<sup>13</sup> [http://www.cra-arc.gc.ca/tax/individuals/faq/2000\\_rate-e.html#federal](http://www.cra-arc.gc.ca/tax/individuals/faq/2000_rate-e.html#federal)  
<http://www.cra-arc.gc.ca/tax/business/topics/payroll/calculating/ei/cont-chart-pf-e.html>  
<http://www.cra-arc.gc.ca/tax/business/topics/payroll/calculating/cpp/cont-chart-pf-e.html>

expense such as textbooks, and of indirect costs representing the foregone earnings of studying.

Tuition fees come from Statistics Canada, *SURVEY OF TUITION AND LIVING ACCOMMODATION COSTS FOR FULL-TIME STUDENTS AT CANADIAN DEGREE-GRANTING INSTITUTIONS 1999-2000 actual*. Statistics Canada provides the data for all Canadian universities. I use the average of all Canadian universities tuition fees without weight in different tuition fees of universities.

Tuition fees are sometimes shown in two levels, upper and lower, especially for Quebec Universities. For example, the lower level is the tuition fees for Quebec residents, while the upper level is the tuition fees for residents of other provinces.

I use the average of the lower and upper tuition fees as the tuition fees. Statistics Canada identifies twelve fields of study which are rearranged into seven fields of study to calculate the tuition fee. The average of agriculture and science tuition fees presents the tuition fee for pure sciences. The average of architecture and engineering tuition fees presents the tuition fee for engineering. The average of art and music tuition fees presents the tuition fee for humanities. The average of household sciences and law tuition fees presents the tuition fee for social sciences. The average of dentistry and medicine tuition fees presents the tuition fee for health sciences. The education and commerce tuition fee are the same as the definition of Statistics Canada. The total undergraduate tuition fee is used for the tuition fee of others that are excluded from the above six fields. The tuition

Rates of Return to University Education in Canada in 2000

fees for all fields of graduates are the average of all universities tuition fees for full time Canadian graduate students, 1999-2000.

I estimate out-of-pocket expense using the estimate of Vaillancout and Bourdeau-Primeau 2002, P. 230 TableA-2. The data are calculated to 2000 dollars using the consumer price index for the subgroup of school textbooks and supplies.

The private costs to university education are shown in Table 4.

<b>Table 4: Annual Private Cost Data Used, 2000</b>		
	Method of Calculation	2000 ( current dollars)
Tuition University, all level	<b>Note:</b> The source is Statistic Canada. Using the most current enrolment data available, average tuition fees have been weighted by the number of students enrolled by institution and field of study. Fees at both public and private institutions are included in the weighted average calculations. <b>Source:</b> Statistics Canada, Centre for Education Statistics. Last modified: 2004-09-01.	
Undergraduate		
All fields		3,447
Education		2,857
Humanities		3,384
Social sciences		3,665
Commerce		3,300
Pure sciences		3,290
Engineering		3,567
Health		7,459
Graduate, all fields	average all of Universities tuition fees for full time Canadian students, 1990-2000	3,177
Other out of pocket, University, all levels	Vaillancout and Bourdeau-Primeau 2002, P. 230 TableA-2. The data are converted to 2000 dollars using the consumer price index for the subgroup of school textbooks and supplies.	1,957

Total public costs are from Statistics Canada, CANSIM Table 385-0007<sup>14</sup>. I use the total expenditures for postsecondary education column. I also use data on enrollment taken from Statistics Canada, CANSIM Table 477-013<sup>15</sup> for bachelor, master and PhD levels and by field of study for bachelor level. The reference point is equal to total costs divided by number of enrolment. Since the costs per university student are available as an aggregate, all levels and fields combined, I break them out by level of education and field of study according to ratio used in Vaillancourt and Bourdeau-Primeau (2002): bachelor's education in humanities, social sciences, commerce and mathematics(1: reference point); pure sciences(1.5); engineering(2); health(3.33); master's education in humanities, social sciences, commerce(2); mathematics and pure sciences, engineering, health(3), and PhD's in all disciplines (6). Those ratios reflect the fact that some levels and fields require more resources than others. Then I calculate the public costs by level and field of studies. The data are shown in Table 5.

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<sup>14</sup> University and college revenue and expenditures

<sup>15</sup> University enrolments, by registration status, program level, Classification of Instructional Programs, Primary Grouping and sex, annual

**Table 5: Public Annual Cost Data Used, 2000**

	Method of Calculation	2000 ( current dollars)
University	Total costs were from Statistics Canada, Table 385-0007. I use total expenditures for postsecondary education column. I also use data on enrollment taken from Statistics Canada, Table 477-0013.	
<b>Breakdowns by program and level</b>		
Reference point		16,414
Undergraduate	Education, humanities, social sciences, commerce, mathematics(1: referencepoint); pure sciences(1.5); engineering(2); health(3.33)	28,232*
Graduate		
Master's	Education, humanities, social sciences, commerce(2); mathematics and pure sciences, engineering, health(3)	40,325**
PhD	All disciplines (6)	98,484***

Source: Statistics Canada, CANSIM Table 385-0007 and Table 477-0013

Vaillancout and Bourdeau-Primeau 2002, P. 230 Table A-2- continued

\* the average public annual costs of seven fields of study for the bachelor level

\*\* the average public annual costs of all fields of study for the master level

\*\*\* the average public annual costs for the PhD level

Foregone earnings are calculated, using the earning equation (4) and coefficients in Table A-1. The numbers of education years necessary for bachelor, master, and PhD degrees are four years, two years, and four years, respectively. Since the school year for post secondary students is about eight months and assuming that they spend the other four months at work, the foregone earnings are two-third of the annual earnings if they did not study further. I summarize the private and total direct and indirect costs in Table 6 for level of education and in Table 7 by field of study.

**Table 6: Private and Public Costs for various levels of education, 2000**

	Direct cost <sup>a</sup>	Forgone Earnings <sup>b</sup>		Total <sup>c</sup>	
		Men	Women	Men	Women
(Current dollars)					
Private costs					
Bachelor	19,256	32,381	21,528	51,637	40,785
Master	21,364	29,260	24,231	50,624	45,595
PhD	22,488	71,125	70,660	93,613	93,148
Total costs					
Bachelor	112,928	36,247	23,961	149,175	136,889
Master	80,650	32,920	27,226	113,570	107,876
PhD	393,936	80,513	76,241	474,449	470,177

a. Total and private costs found in Table A-3 and A-4 times the number of years of education necessary

b. Two-third times the annual earnings that have been gained if the person did not study further

c. Direct costs plus forgone earnings

**Table 7: Private and Public Costs, Bachelor's degree, by field of study, 2000**

	Direct cost <sup>a</sup>	Forgone Earnings <sup>b</sup>		Total <sup>c</sup>	
		Men	Women	Men	Women
(Current dollars)					
Private costs					
Education	19,256	32,381	21,528	51,637	40,785
Humanities	21,364	32,381	21,528	53,745	42,893
Social Sciences	22,488	32,381	21,528	54,869	44,017
Commerce	21,028	32,381	21,528	53,409	42,557
Pure Sciences	20,988	32,381	21,528	53,369	42,517
Engineering	22,096	32,381	21,528	54,477	43,625
Health Sciences	37,664	32,381	21,528	70,045	59,193
Total costs					
Education	98,484	36,247	23,961	134,731	122,445
Humanities	98,484	36,247	23,961	134,731	122,445
Social Sciences	98,484	36,247	23,961	134,731	122,445
Commerce	98,484	36,247	23,961	134,731	122,445
Pure Sciences	98,484	36,247	23,961	134,731	122,445
Engineering	131,312	36,247	23,961	167,559	155,273
Health Sciences	393,936	36,247	23,961	430,183	417,897

a. Total and private costs found in Table A-3 and A-4 times the number of years of education necessary

b. Two-third times the annual earnings that have been gained if the person did not study further

c. Direct costs plus forgone earnings

Finally, internal rates of return to education are calculated so that the present values of total costs and benefits are the same.

The differences in wages between bachelor by field of study and high school are shown in Table A-3 for male and in Table A-4 for females. The first part of both tables shows for each age the difference in gross wages between bachelor by field of study and high school level, with the second row showing total public costs during the bachelor. The second part of both tables shows for each age the difference in net wages, with the second rows showing total private costs during the bachelor.

For example, the first part of Table A-3 shows the difference in male gross earnings between bachelor by field of study and high school level. The first column shows the ages from graduation to retirement as well as the "cost" in the second row and "IRR" (internal rates of return) in the last row; the second to the eighth column show the difference in male earnings between bachelor in different fields and high school for each age. The second row shows the total public cost during the bachelor studies. For example, the amount of \$5,449.27 in the second column and the third row shows that the gross earnings at 22 years old of men holding a bachelor degree in education are higher by \$5,449.27 than those of men holding only a high school diploma. The last row shows the total rates of return (IRRs) calculated by the difference in earnings from third row to 44<sup>th</sup> row

discounted over time until it is equal to the total costs in the second row. This is based on equation (3) above.

The differences in gross and net wages between bachelor and high school for males and for females are shown in Table A-5 and Table A-6, those between master and bachelor for males and for females are shown in Table A-7 and Table A-8, and those between PhD and master for males and females are shown in Table A-9 and Table A-10. For example, the first column of Table A-5 shows the ages from graduation to retirement as well as “cost” in the second row and “IRR” in the last row; the second and third column show respectively the gross and net wages for bachelor level, the fourth and fifth column show respectively the gross and net wages for high school level, and the sixth and seventh column show respectively differences in gross and net wages for male between bachelor and high school by age. The intersections of the second row and sixth and seventh columns show respectively the total public and private cost during the bachelor studies.

For example, the amount of \$8,570.08 in the sixth column and the third row of Table A-5 shows that the earnings at 22 years old of men holding a bachelor degree are higher by \$8,570.08 than those of individuals holding only high school diploma. The number 9.3% and 16.5% in the last row and last two columns show respectively the total and private rates of return (IRRs) calculated from equation

(3). Table A-6, Table A-7, Table A-8, Table A-9, and Table A-10 are constructed in the same way as Table A-5.

#### **4. Empirical findings for 2001**

In this section of the paper, I present the results by level of education and by field of study. The rates of return by level of education, which come from the last rows of Table A-5 to Table A-10 in the appendix, are put together in Table 8.

**Table 8: Private and Total Rates of Return by Level of University Education, 2000**

	Bachelor's	Master's (percent)	PhD
Men			
Private	16.5%	2.6%	-0.3%
Total	9.4%	0.9%	-3.2%
Women			
Private	20.3%	6.5%	1.9%
Total	9.3%	3.7%	-2.6%

The findings may be summarized in three points. First of all, the highest total and private rates of return to education for 2000 resulted from obtaining a bachelor degree. The highest total rates of return are 9.4 percent for men and 9.3 percent for women and the highest private rates of return are 16.5 percent for men and 20.3 percent for women in 2000. Second, both the private and total rates of return of women are higher than those of men, with the exception of the bachelor level where both total rates of return (9.4% and 9.3%) are similar. Third, rates of return decrease by level of education attained, which follows from the theory of diminishing return.

The calculated rates of return in 2000 for bachelor degree are very similar to those in 1985, 1990 and in 1995 of Vaillancourt (1995) and Vaillancourt and Bourdeau-Primeau (2002). The rates of return for master and PhD degree are different from the results of Vaillancourt and Bourdeau-Primeau (2002). I summarize the rates of return obtained by those authors, in 1995, in 1990, and in 1985 in Table 9. The total and private rates of return for masters, for both men and women, are higher than those for PhDs in 1990, while the opposite is true in 1995. They do not provide the exact number of the rates of return for male masters; they only say that the rates for this level are negative in 1995.

**Table 9: Private and Total Rates of Return by Level of University Education, 1995, 1990, and 1985**

	Bachelor's	Master's 1995	PhD
<b>1995</b>			
Men			
Private	17.0%	<0	3.0%
Total	10.0%	<0	-2.0%
Women			
Private	20.0%	5.0%	12.0%
Total	10.0%	0.0%	2.0%
<b>1990</b>			
Men			
Private	16.0%	9.0%	7.0%
Total	8.0%	4.0%	1.0%
Women			
Private	19.0%	10.0%	8.0%
Total	8.0%	4.0%	-2.0%
<b>1985</b>			
Men			
Private	8.3%	6.5%	1.2%
Total	4.3%	2.4%	-2.3%
Women			
Private	18.8%	0.1%	16.3%
Total	8.4%	-4.9%	2.5%

Data in 1995 and 1990 are based on Vaillancourt and Bourdeau-Primeau (2002)  
Data in 1985 are based on Vaillancourt (1995)

The rates of return at the bachelor level by field of study, which come from the last rows of Table A-3 and Table A-4 in the appendix, are shown in Table 6.

**Table 10: Private and Total Rates of Return to a Bachelor's Degree by field of study, 2000**

	Education	Humanities	Social Sciences	Commerce	Pure Sciences	Engineering	Health Sciences
Men							
Private	11.4%	3.8%	15.2%	19.6%	18.8%	22.9%	12.3%
Total	6.3%	1.3%	9.8%	12.3%	11.3%	12.0%	1.9%
Women							
Private	18.1%	14.4%	17.7%	24.5%	20.5%	29.0%	17.2%
Total	9.5%	7.3%	9.8%	12.7%	11.0%	10.0%	2.8%

I find that the rates of return to the bachelor level vary by field of study, the highest return being in engineering and the lowest being in the humanities. The private rates of return are a little more or less than twice the total rates of return, with the exception of health science for both men and women where the private rates are much higher than the total rates.

My results by field of study agree with those of Vaillancourt and Bourdeau-Primeau (2002). I summarize their rates of return to bachelor's degree by field of study, in 1995, in 1990, and in 1985 in Table 11. The highest rate of return by field of study for the bachelor level is in engineering and the lowest is in the humanities, with exception of engineering for women in 1995 and 1985. The order of rates of return by field of study is consistent with one of Vaillancourt (1995) and Vaillancourt and Bourdeau-Primeau (2002).

Rates of Return to University Education in Canada in 2000

	Education	Humanities	Social Sciences	Commerce	Pure Sciences	Engineering	Health Sciences
1995							
Men							
Private	14.0%	-3.0%	15.0%	20.0%	19.0%	24.0%	18.0%
Total	11.0%	<0	12.0%	15.0%	8.0%	12.0%	4.0%
Women							
Private	19.0%	13.0%	18.0%	25.0%	22.0%	25.0%	28.0%
Total	13.0%	8.0%	12.0%	17.0%	8.0%	8.0%	5.0%
1990							
Men							
Private	19.0%	1.0%	12.0%	15.0%	14.0%	20.0%	8.0%
Total	6.0%	<0	9.0%	10.0%	7.0%	9.0%	<0
Women							
Private	19.0%	13.0%	19.0%	27.0%	22.0%	37.0%	26.0%
Total	11.0%	7.0%	11.0%	16.0%	9.0%	11.0%	3.0%
1985							
Men							
Private	9.8%	0.7%	10.8%	19.6%	10.6%	23.0%	9.2%
Total	5.8%	-0.1%	8.8%	13.5%	5.9%	11.7%	-0.7%
Women							
Private	16.3%	5.5%	16.3%	23.9%	16.3%	16.0%	26.6%
Total	8.5%	1.9%	8.5%	11.9%	5.1%	5.1%	3.0%

Data in 1995 and 1990 are based on Vaillancourt and Bourdeau-Primeau (2002)  
 Data in 1985 are based on Vaillancourt (1995)

## 5. Earnings profiles by age

In this part of this paper, I analyze some of the reasons for the different rates of return by level of education and by field of study by looking at wage profiles by age. Figure 1 and Figure 2, which are charted using the data from Tables A-5, A-7, and A-9, display respectively the gross and net wage profiles of males by level of education. The differences in wages between bachelor and high school are quite obvious, while the wages of bachelors are slightly lower than those of masters. However, at the beginning of life cycle, the wages of masters with

experience are greater than those of the fresh PhDs. At about 45 years of age, the PhDs catch up with the masters. After that, the earnings of the PhDs are higher than those of the masters. The present value of these differences in wages between PhDs and masters after 45 years old has less effect than those of differences that happened at the beginning of the cycle life because discounting decreases the value of earnings received with time. Furthermore, total private costs of PhDs are almost twice those of masters, while total public costs of PhD are more than four times those of master in Table 6. Therefore, those factors explain that the total and private rates of return for the PhD level are the lowest among the three levels of university education and that the total rates of return for PhD level are negative.

Figure 3 and Figure 4, which are charted using the data from Table A-6, Table A-8, and Table A-10, show the same wage profiles for females. The shapes for female are similar to those of males, except for the PhD level. The differences in earnings between female masters and female PhDs are less than those of between male masters and male PhDs at the beginning of life cycle. Furthermore, the female PhDs catch up with the masters at about 35 years old, which is 10 years earlier than those for males; this explains why the rates of returns for women are higher than those of men. However, in my study, I ignore earnings received during the PhD. Usually, PhD students can obtain funding, such as teaching and research assistants during their studies. This factor may lead to an underestimation of the rates of returns for the PhD level.

# Rates of Return to University Education in Canada in 2000

Figure 1. The total wages for male by level of education

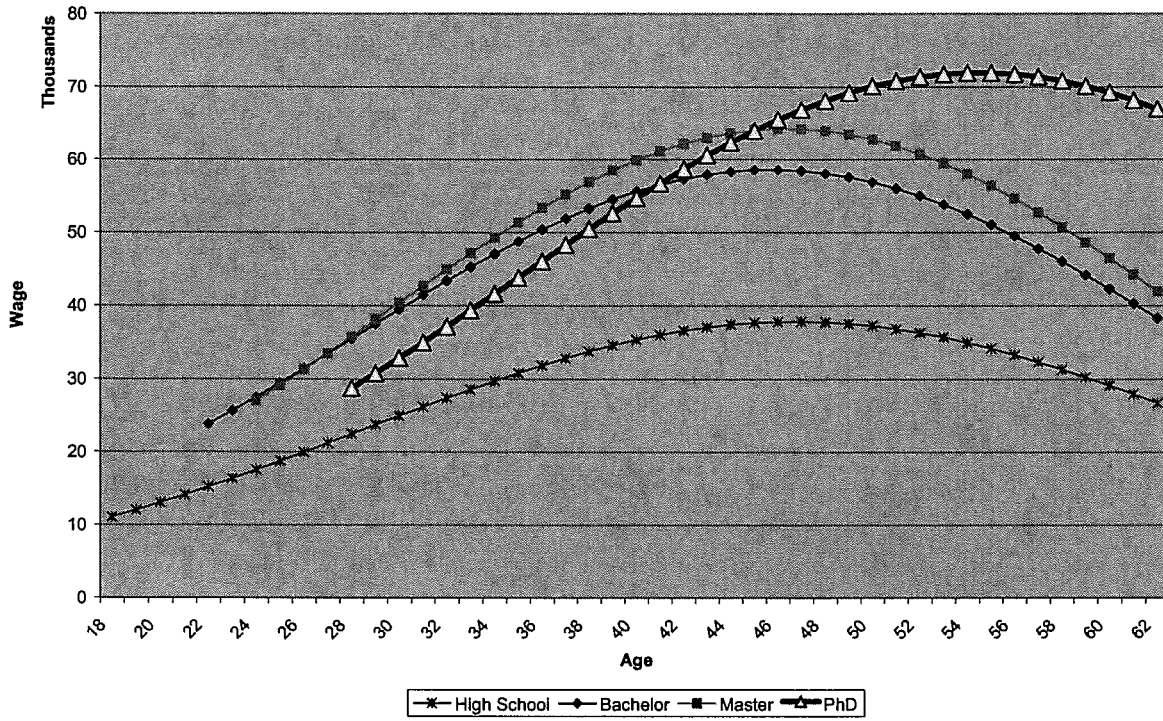
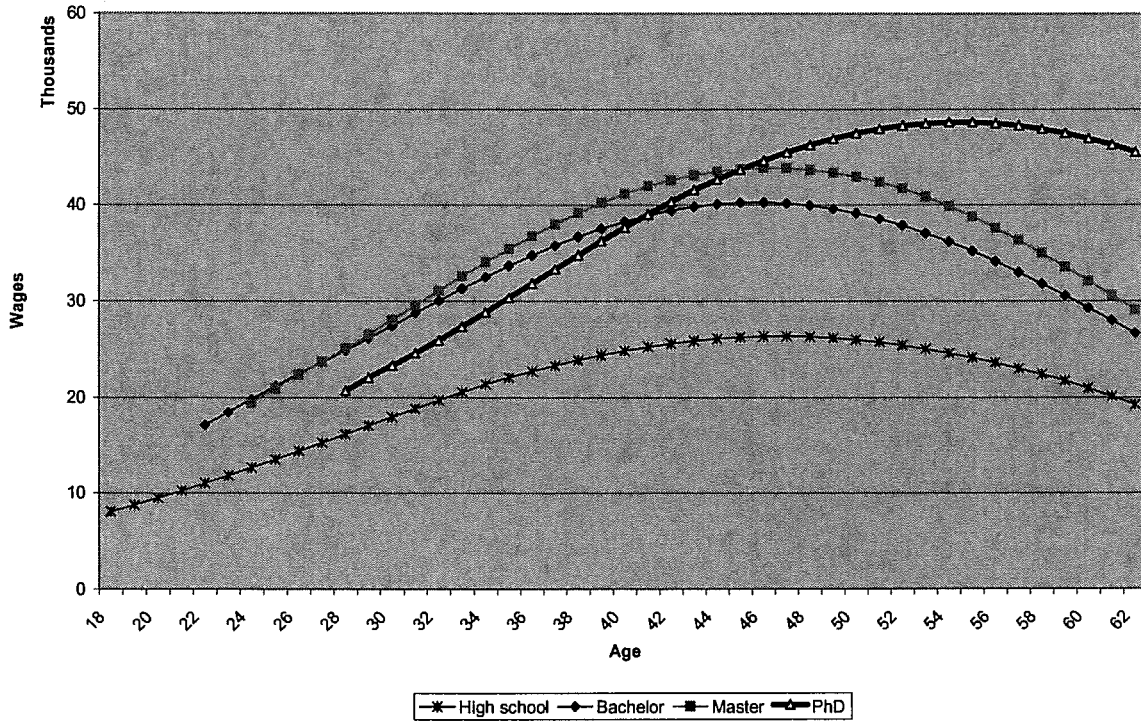


Figure 2. The after-tax wages for male by level of education



# Rates of Return to University Education in Canada in 2000

Figure 3. The total wages for female by level of education

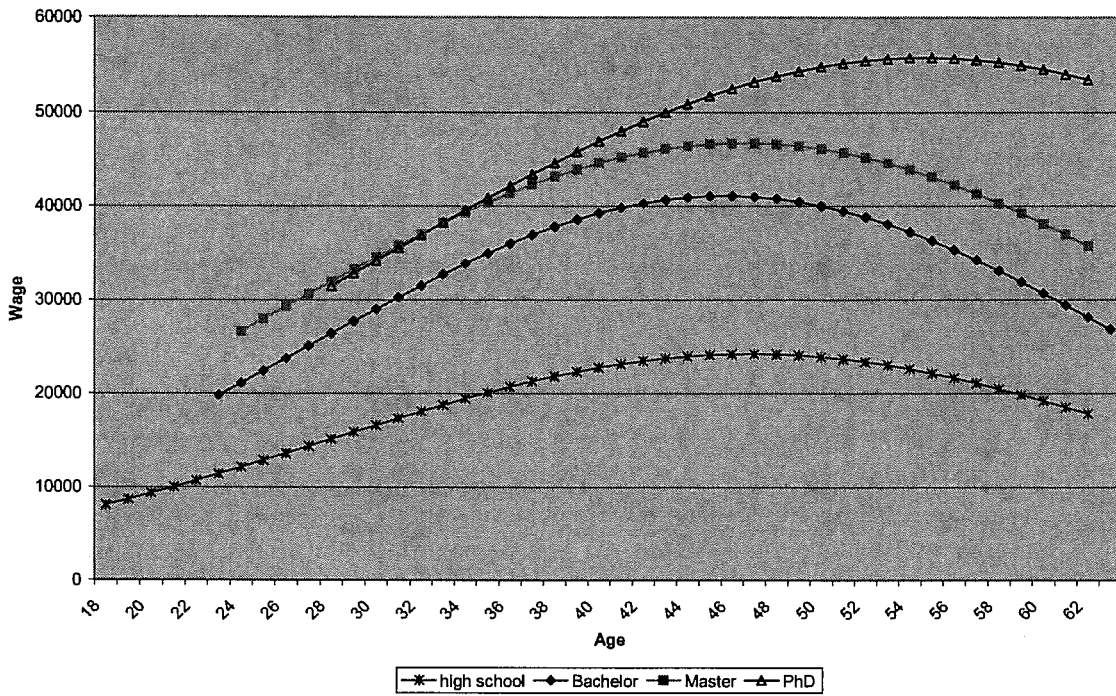
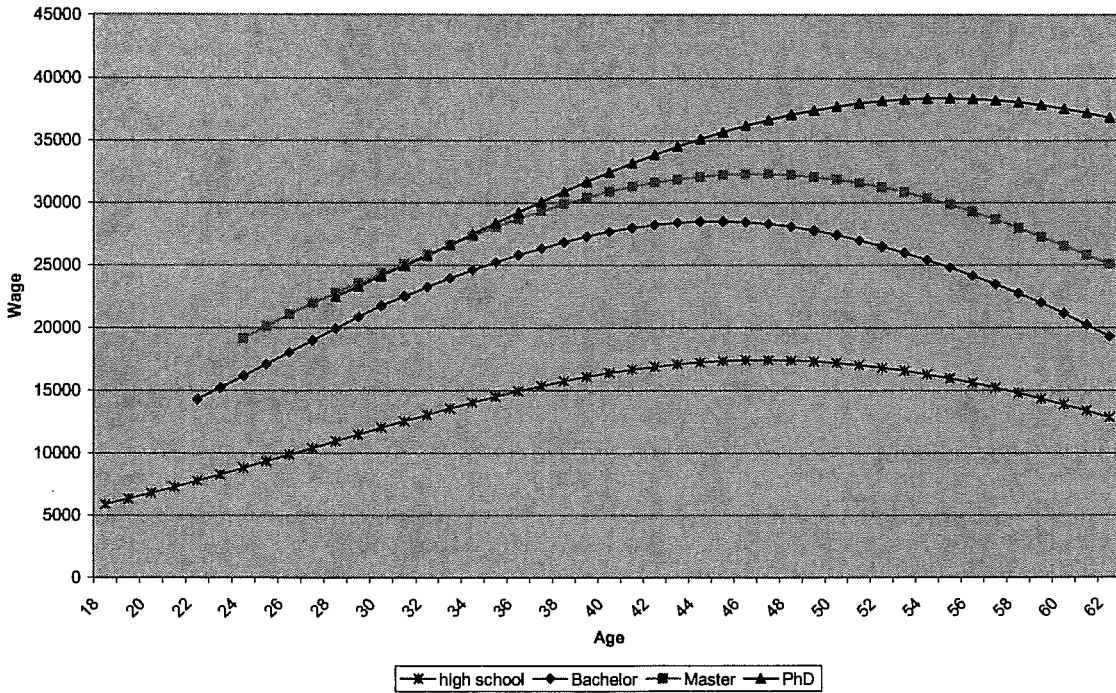


Figure 4. The after-tax wages for female by level of education



The differences in total and private earnings of men between bachelor in different fields and high school are shown in Figure 5 and Figure 6, which are charted using the data from Table A-3. The men who study engineering have the largest earnings compared to those with high school diploma, the men in commerce have the second largest ones, those in education have the second smallest one, and those in humanities have the smallest ones. The men in social science, pure science, and health science have similar earnings. Those results are consistent with peoples' belief that engineer and science are more difficult.

Figure 7 and Figure 8, which are charted using the data from Table A-4 show that the differences in earnings of women among the fields are lower than those of men. The women who study humanities have the smallest earnings compared to those with high school diploma, those in pure science have the second smallest ones, those in health science and commerce also have quite similar earnings, and the women in education and social science have quite similar ones. An interesting finding is that the earnings profiles of women who study engineering are quite different from those of other fields and from those of males. After about age 30, the differences in earnings between females holding a bachelor degree in engineering and those holding a high school diploma decrease and at about age 54, the wages of females holding a bachelor in engineering are less than those of females with a high school. This is a bit surprising. In order to see if the result is robust, I also used the Vaillancourt and Bourdeau-Primeau's (2002) regressions, in their Tables A-3, A-4, A-5 and A-6 (page 232-235), to calculate

the differences in earnings of females between bachelor by field of study and high school in 1990, as shown Table A-11, and in 1995, as shown in Table A-12. Figures 9 and 10 are drawn using those data. My findings are similar with to those of Vaillancourt and Bourdeau-Primeau's results, including the field of engineering. Those results may reflect the reason why there are few females in programs of engineering and more in education and humanities. They may also reflect the fact that the knowledge and skills in engineering, such as computer science, become obsolete more quickly than in other fields. The females after 30 years old may put more turn on their families. This is a very interesting finding, which certainly deserves further studies.

Figure 5. The differences of total wages between bachelor by field of study and high school for male

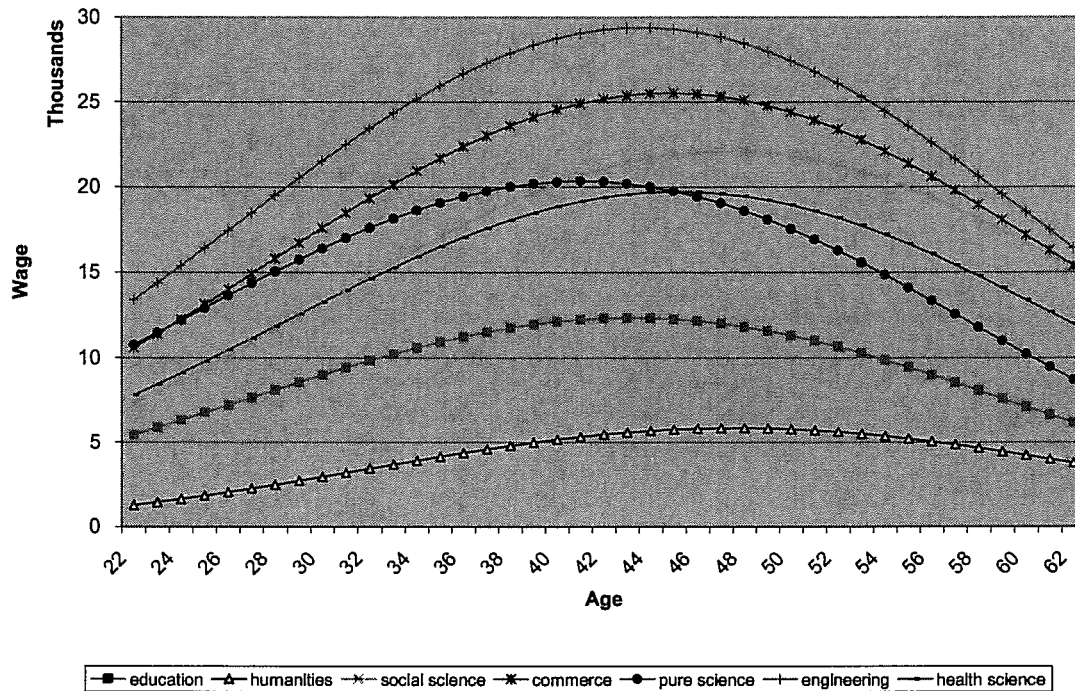
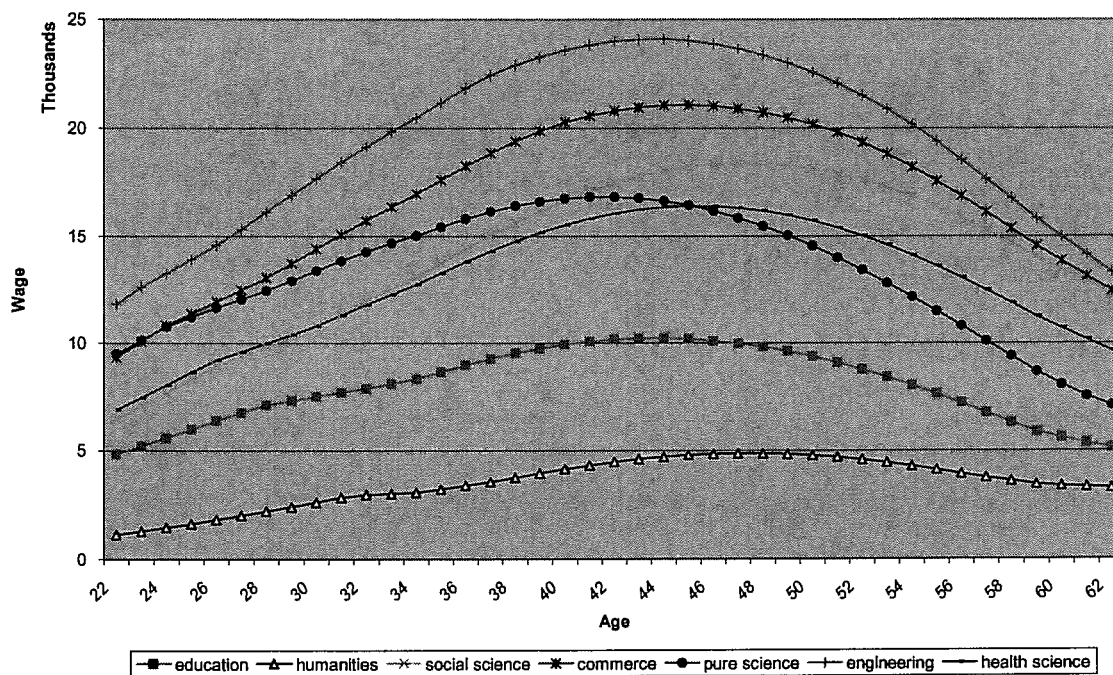


Figure 6. The differences of after-tax wages between bachelor by field of study and high school for male



Rates of Return to University Education in Canada in 2000

Figure 7. The differences of total wages between bachelor by field of study and high school for female

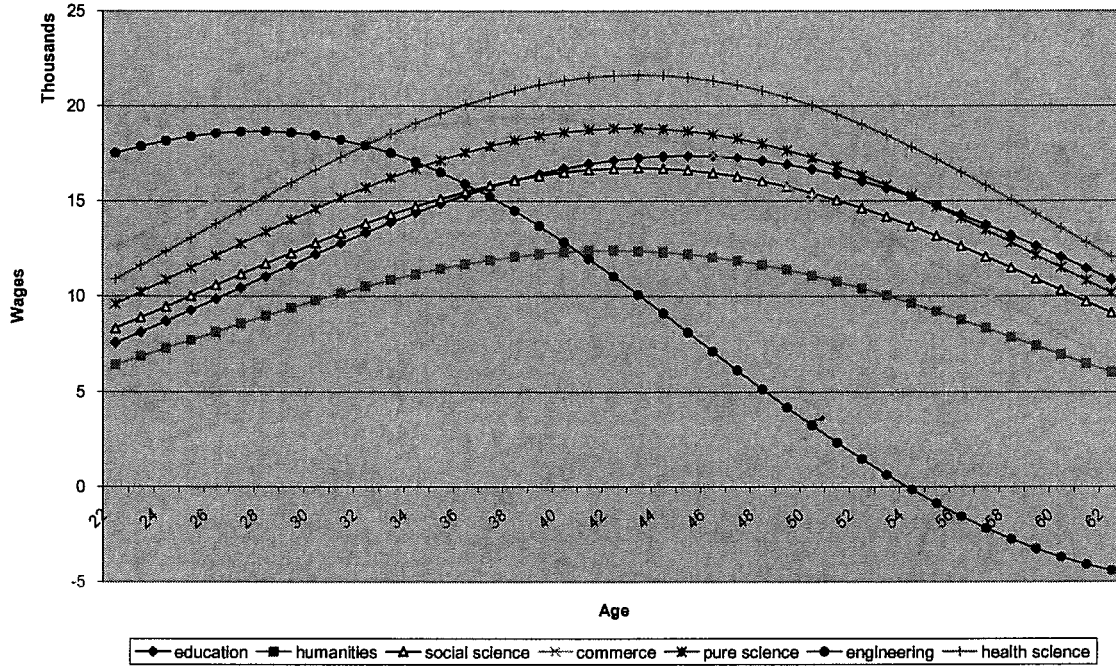
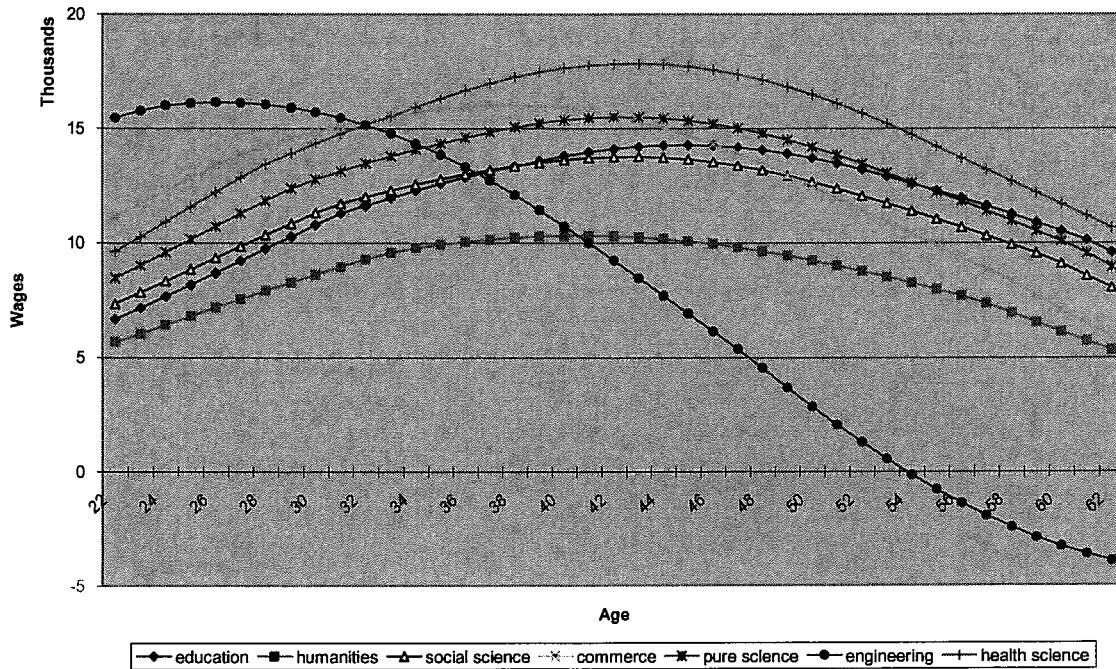
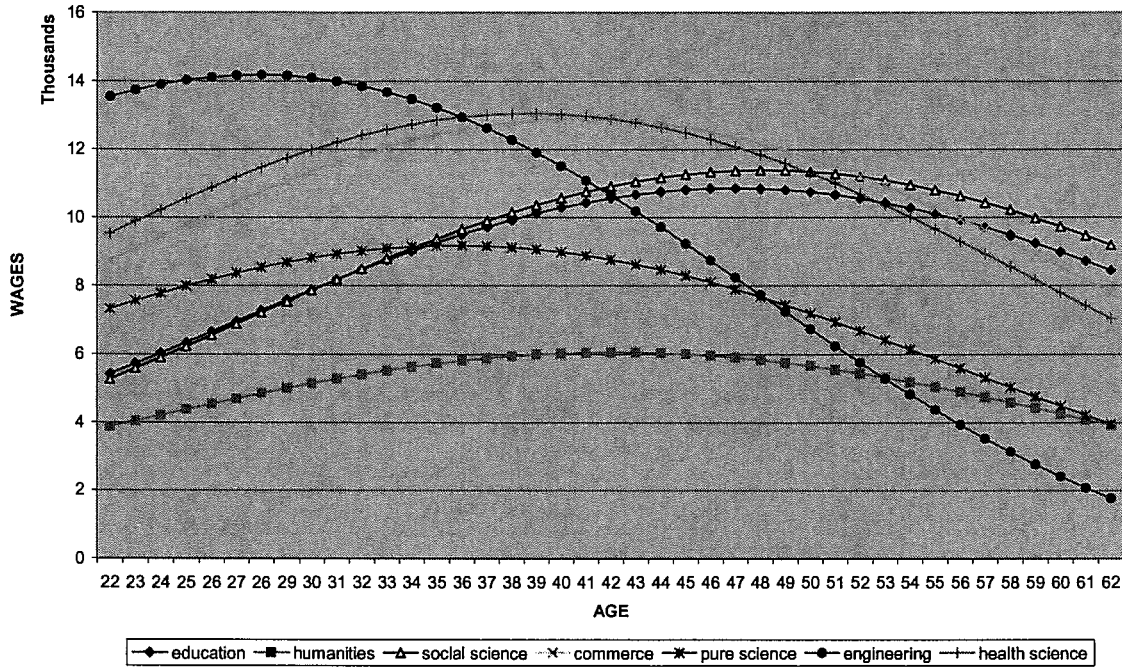


Figure 8. The differences of after-tax wages between bachelor by field of study and high school for female

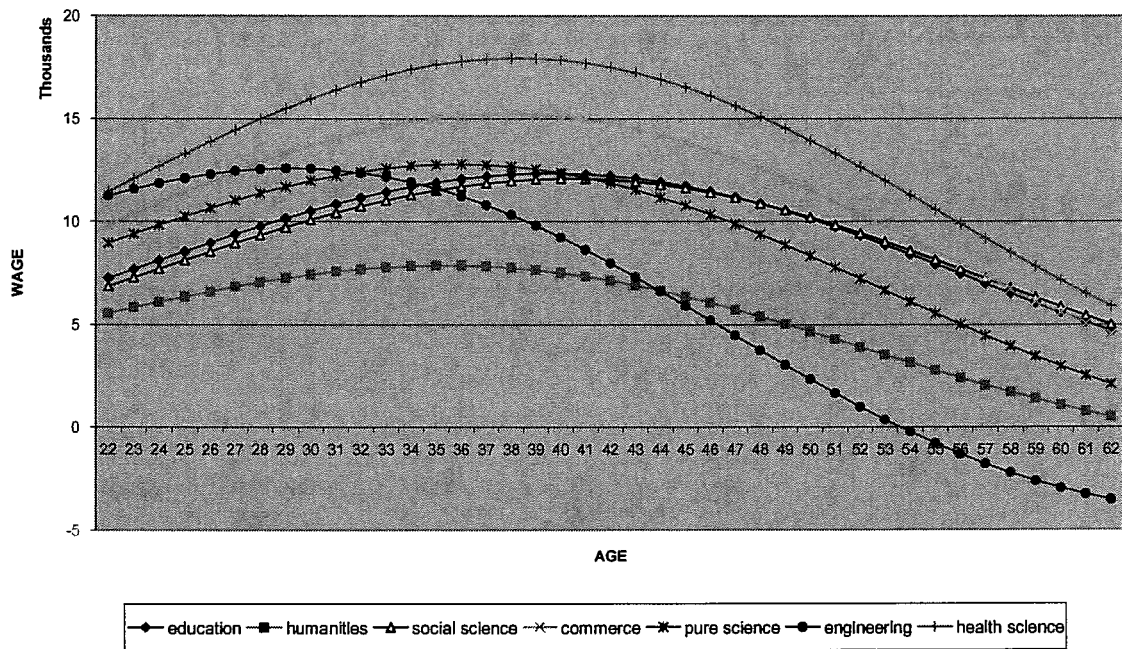


Rates of Return to University Education in Canada in 2000

**Figure 9. The difference of total female wage between bachelor by field of study and high school in 1990, based on Vaillancourt and Bourdeau-Primeau.**



**Figure 10. The differences of total female wages between bachelor by field of study and high school in 1995, based on Vaillancourt and Bourdeau-Primeau.**



## **6. Conclusion**

The results of this paper indicate that rates of return to university education vary by sex, by level of education, and by field of study for the bachelor degree. The results are also consistent with those of Vaillancourt (1995) and Vaillancourt and Bourdeau-Primeau (2002) study.

The findings may be summarized in four points. First of all, the highest total and private rates of return to education for 2000 resulted from obtaining a bachelor degree. Second, both the private and total rates of return of women are higher than those of men. Third, rates of return tend to decline by level of education attained. Finally, the rates of return to the bachelor level vary by field of study, with the highest return being in engineering and the lowest in the humanities.

According to Vaillancourt (1995), Vaillancourt and Bourdeau-Primeau (2002) and my study, using the similar methodology and applying it to on the Canadian censuses of 1985, 1990, 1995, and 2000, rates of return for bachelor level are the highest in the university levels, including bachelor, master and PhD levels, and they are relative stable in those four years. However, rates of return for master and PhD levels fluctuate during the same period. An interesting avenue of further research would be to check whether the choice of pursuing master or PhD degree is more sensitive to the state of economic activity than the one of pursuing bachelor degree.

Rates of Return to University Education in Canada in 2000

Another interesting direction for further research may be to find the factors that explain why the wage profiles of females holding bachelor in engineering are so different from those of other fields and from those of males.

Appendix

**Table A-1: Regression Results, by Level of Education, OLS in 2000 (2001 census)**

	High school	Bachelor's Degree	Master's Degree	PHD
<b>Male</b>				
Intercept	7.28833 <i>123.15</i>	7.62772 <i>86.11</i>	7.33364 <i>34.78</i>	7.30345 <i>14.73</i>
AGEP	0.13915 <i>43.71</i>	0.14657 <i>33.18</i>	0.16126 <i>16.38</i>	0.14234 <i>6.61</i>
AGEPSQU	-0.00149 <i>-36.75</i>	-0.0016 <i>-30.29</i>	-0.00174 <i>-15.62</i>	-0.00131 <i>-5.73</i>
<b>R<sup>2</sup></b>	0.1374	0.0713	0.0468	0.0662
<b>F</b>	1781.6	772.58	151.26	55.89
<b>N</b>	22367	20136	6160	1581
<b>Female</b>				
Female Intercept	7.18272 <i>112.59</i>	7.78647 <i>92.45</i>	8.34045 <i>34.76</i>	8.5197 <i>11.22</i>
AGEP	0.1243 <i>36.77</i>	0.127 <i>28.86</i>	0.10379 <i>8.97</i>	0.08812 <i>2.58</i>
AGEPSQU	-0.00133 <i>-30.97</i>	-0.00142 <i>-25.87</i>	-0.00112 <i>-8.27</i>	-0.00080554 <i>-2.15</i>
<b>R<sup>2</sup></b>	0.1049	0.0653	0.0258	0.0369
<b>F</b>	1210.22	656.28	55.47	10.72
<b>N</b>	20664	18805	4189	563

Note: T- statistics are in italic

Source: regression in SAS, based on individual microdata file, the 2001 Canadian census

**Table A-2 : Regression results, Bachelor's level, by Field of study, In 2000(2001 census)**

	Male		Female	
	Estimate	t Value	Estimate	t Value
Intercept	7.53586	<i>67.25</i>	7.60344	<i>78.08</i>
AGEP	0.14365	<i>30.66</i>	0.13186	<i>28.4</i>
AGEPSQU	-0.00157	<i>-29.99</i>	-0.00144	<i>-25.79</i>
field of study				
Humanities	-0.30914	<i>-3.13</i>	0.0021	<i>0.03</i>
Social Sciences	-0.00017913	<i>0</i>	0.09844	<i>1.5</i>
Commerce	0.20735	<i>2.36</i>	0.46403	<i>5.98</i>
Pure Sciences	0.31232	<i>3.41</i>	0.17774	<i>2.15</i>
Engineering	0.35517	<i>4.06</i>	1.09479	<i>7.48</i>
Health sciences	0.07684	<i>0.49</i>	0.23894	<i>2.96</i>
Others	-1.08299	<i>-1.95</i>	-0.04203	<i>-0.11</i>
field of study * age				
Humanities age	0.00377	<i>1.61</i>	-0.00301	<i>-1.71</i>
Social Sciences age	0.00393	<i>1.87</i>	-0.0026	<i>-1.57</i>
Commerce age	0.00062761	<i>0.3</i>	-0.01004	<i>-4.99</i>
Pure Sciences age	-0.00383	<i>-1.75</i>	-0.00326	<i>-1.56</i>
Engineering age	-0.00136	<i>-0.66</i>	-0.02995	<i>-7.39</i>
Health sciences age	0.00138	<i>0.37</i>	-0.00319	<i>-1.63</i>
Others age	0.02417	<i>1.93</i>	-0.00256	<i>-0.26</i>
<b>R<sup>2</sup></b>	0.1011		0.0772	
<b>F</b>	141.41		98.4	
<b>N</b>	20136		18805	

Note: T- statistics are in italic

Source: regression in SAS, based on individual microdata file, the 2001 Canadian census

**Table A-3: The difference in male total wages between high school level and bachelor by field of study**

<b>Age</b>	<b>Bachelor in Education and high school</b>	<b>Bachelor in Humanities and High school</b>	<b>Bachelor in Social science and High school</b>	<b>Bachelor in Commerce and High school</b>	<b>Bachelor in Pure Science and High school</b>	<b>Bachelor in Engineering and High school</b>	<b>Bachelor in Health Science and High school</b>
<b>Cost</b>	-131,966.93	-131,966.93	-131,966.93	-131,966.93	-131,966.93	-164,794.93	-427,418.93
<b>22</b>	5,449.27	1,268.38	7,308.80	10,560.80	10,737.29	13,388.79	7,787.52
<b>23</b>	5,874.00	1,443.71	7,969.49	11,389.64	11,455.32	14,372.47	8,423.37
<b>24</b>	6,309.02	1,630.53	8,658.53	12,241.99	12,179.72	15,377.09	9,079.39
<b>25</b>	6,751.86	1,828.21	9,373.35	13,113.65	12,905.69	16,397.18	9,752.47
<b>26</b>	7,199.78	2,035.98	10,110.87	13,999.93	13,628.16	17,426.71	10,439.07
<b>27</b>	7,649.79	2,252.84	10,867.57	14,895.65	14,341.73	18,459.19	11,135.25
<b>28</b>	8,098.71	2,477.63	11,639.43	15,795.18	15,040.81	19,487.68	11,836.72
<b>29</b>	8,543.12	2,708.97	12,422.01	16,692.53	15,719.64	20,504.87	12,538.85
<b>30</b>	8,979.50	2,945.34	13,210.47	17,581.34	16,372.38	21,503.18	13,236.70
<b>31</b>	9,404.19	3,185.05	13,999.59	18,455.03	16,993.21	22,474.80	13,925.12
<b>32</b>	9,813.47	3,426.24	14,783.85	19,306.78	17,576.35	23,411.85	14,598.78
<b>33</b>	10,203.64	3,666.96	15,557.47	20,129.72	18,116.21	24,306.41	15,252.21
<b>34</b>	10,570.99	3,905.14	16,314.49	20,916.94	18,607.42	25,150.71	15,879.94
<b>35</b>	10,911.95	4,138.64	17,048.82	21,661.60	19,044.96	25,937.15	16,476.48
<b>36</b>	11,223.09	4,365.27	17,754.34	22,357.05	19,424.22	26,658.49	17,036.50
<b>37</b>	11,501.17	4,582.85	18,424.99	22,996.92	19,741.07	27,307.91	17,554.81
<b>38</b>	11,743.24	4,789.20	19,054.84	23,575.18	19,991.93	27,879.12	18,026.51
<b>39</b>	11,946.62	4,982.21	19,638.16	24,086.29	20,173.87	28,366.49	18,447.04
<b>40</b>	12,109.03	5,159.86	20,169.54	24,525.25	20,284.61	28,765.11	18,812.24
<b>41</b>	12,228.55	5,320.27	20,643.97	24,887.68	20,322.59	29,070.89	19,118.44
<b>42</b>	12,303.71	5,461.68	21,056.88	25,169.90	20,287.00	29,280.59	19,362.49
<b>43</b>	12,333.50	5,582.56	21,404.26	25,369.01	20,177.82	29,391.94	19,541.86
<b>44</b>	12,317.37	5,681.58	21,682.68	25,482.89	19,995.78	29,403.62	19,654.63
<b>45</b>	12,255.29	5,757.64	21,889.39	25,510.29	19,742.38	29,315.33	19,699.57
<b>46</b>	12,147.71	5,809.91	22,022.34	25,450.82	19,419.87	29,127.77	19,676.12
<b>47</b>	11,995.57	5,837.83	22,080.21	25,304.98	19,031.21	28,842.62	19,584.43
<b>48</b>	11,800.29	5,841.13	22,062.43	25,074.11	18,580.05	28,462.56	19,425.36
<b>49</b>	11,563.73	5,819.81	21,969.23	24,760.44	18,070.61	27,991.18	19,200.44
<b>50</b>	11,288.21	5,774.17	21,801.56	24,366.97	17,507.68	27,432.96	18,911.86
<b>51</b>	10,976.39	5,704.80	21,561.17	23,897.51	16,896.53	26,793.17	18,562.45
<b>52</b>	10,631.32	5,612.54	21,250.47	23,356.54	16,242.79	26,077.81	18,155.62
<b>53</b>	10,256.30	5,498.50	20,872.60	22,749.19	15,552.43	25,293.50	17,695.29
<b>54</b>	9,854.92	5,364.01	20,431.29	22,081.13	14,831.58	24,447.39	17,185.85
<b>55</b>	9,430.93	5,210.61	19,930.86	21,358.53	14,086.55	23,547.06	16,632.11
<b>56</b>	8,988.19	5,040.03	19,376.10	20,587.88	13,323.63	22,600.37	16,039.14
<b>57</b>	8,530.68	4,854.14	18,772.24	19,776.00	12,549.07	21,615.39	15,412.31
<b>58</b>	8,062.34	4,654.94	18,124.85	18,929.83	11,769.00	20,600.26	14,757.12
<b>59</b>	7,587.10	4,444.50	17,439.73	18,056.43	10,989.29	19,563.09	14,079.16
<b>60</b>	7,108.78	4,224.95	16,722.89	17,162.82	10,215.56	18,511.85	13,384.03
<b>61</b>	6,631.06	3,998.43	15,980.38	16,255.91	9,453.03	17,454.27	12,677.24
<b>62</b>	6,157.41	3,767.07	15,218.29	15,342.43	8,706.55	16,397.76	11,964.19
<b>IRR</b>	6.3%	1.3%	9.8%	12.3%	11.3%	12.0%	1.9%

**Table A-3 continued. The difference in after-tax wages for male between high school level and bachelor**

Age	Bachelor in Education and high school	Bachelor in Humanities and High school	Bachelor in Social science and High school	Bachelor in Commerce and High school	Bachelor in Pure Science and High school	Bachelor in Engineering and High school	Bachelor in Health Science and High school
<b>Cost</b>	-49,195.59	-51,303.59	-52,427.59	-50,967.59	-50,927.59	-52,035.59	-67,603.59
22	3,896.15	906.87	5,225.68	7,550.81	7,677.00	9,572.78	5,567.96
23	4,199.82	1,032.23	5,698.06	8,143.42	8,190.38	10,200.47	6,022.58
24	4,510.86	1,165.80	6,190.72	8,752.84	8,708.31	10,686.29	6,491.63
25	4,827.48	1,307.15	6,701.80	9,181.76	9,055.30	11,178.51	6,972.87
26	5,147.73	1,455.70	7,225.22	9,590.20	9,364.12	11,674.05	7,424.80
27	5,469.49	1,610.75	7,553.08	10,002.60	9,665.75	12,263.70	7,715.86
28	5,735.94	1,771.47	7,889.09	10,440.06	9,957.50	12,899.18	8,009.07
29	5,872.50	1,936.87	8,231.29	10,968.44	10,315.53	13,526.94	8,302.34
30	6,004.65	2,105.88	8,597.95	11,510.25	10,698.90	14,142.23	8,614.93
31	6,131.01	2,277.26	9,052.35	12,042.44	11,061.40	14,740.15	9,002.37
32	6,250.19	2,366.05	9,525.43	12,560.81	11,399.50	15,315.76	9,401.22
33	6,405.63	2,385.80	9,992.62	13,061.10	11,709.81	15,864.12	9,787.76
34	6,595.79	2,407.97	10,450.31	13,539.05	11,989.11	16,380.38	10,158.67
35	6,860.82	2,516.75	10,979.33	14,075.02	12,318.96	16,944.38	10,595.23
36	7,135.65	2,654.56	11,518.84	14,607.77	12,639.51	17,494.51	11,037.09
37	7,384.38	2,786.87	12,031.03	15,099.29	12,914.26	17,985.71	11,447.04
38	7,604.53	2,948.78	12,511.41	15,545.06	13,140.31	18,348.49	11,821.29
39	7,793.82	3,119.94	12,955.69	15,940.88	13,315.21	18,658.61	12,156.32
40	7,950.29	3,286.64	13,359.79	16,282.94	13,437.01	18,912.96	12,448.89
41	8,072.26	3,436.04	13,719.93	16,521.72	13,504.25	19,108.95	12,696.13
42	8,158.36	3,566.61	14,032.70	16,702.14	13,516.03	19,244.51	12,895.58
43	8,207.62	3,677.01	14,295.10	16,830.10	13,472.03	19,318.20	13,045.23
44	8,219.42	3,766.08	14,504.58	16,904.25	13,372.48	19,329.15	13,143.53
45	8,192.00	3,831.36	14,657.54	16,922.26	13,216.65	19,275.60	13,187.92
46	8,123.14	3,869.78	14,750.10	16,881.49	13,003.56	19,155.61	13,175.53
47	8,021.69	3,889.17	14,789.59	16,790.51	12,743.38	18,978.47	13,114.65
48	7,888.59	3,889.33	14,775.61	16,650.17	12,438.55	18,745.85	13,005.85
49	7,722.13	3,867.32	14,705.36	16,458.83	12,088.96	18,456.98	12,847.20
50	7,517.89	3,817.37	14,573.51	16,212.30	11,691.84	18,108.55	12,634.20
51	7,282.54	3,744.72	14,386.09	15,917.65	11,255.60	17,708.56	12,373.62
52	7,018.34	3,650.19	14,144.96	15,558.36	10,784.26	17,260.75	12,067.97
53	6,727.81	3,534.80	13,852.51	15,111.91	10,282.09	16,769.28	11,720.19
54	6,413.68	3,399.78	13,511.59	14,618.81	9,753.57	16,206.83	11,333.54
55	6,078.85	3,246.55	13,125.46	14,083.58	9,203.28	15,552.33	10,911.63
56	5,726.34	3,092.99	12,697.77	13,511.01	8,635.89	14,861.61	10,458.30
57	5,359.26	2,951.85	12,232.48	12,906.11	8,056.05	14,140.54	9,977.60
58	4,980.76	2,830.72	11,733.81	12,274.04	7,468.34	13,395.08	9,473.70
59	4,622.32	2,702.74	11,206.17	11,620.04	6,877.22	12,631.18	8,950.86
60	4,419.01	2,665.32	10,750.20	11,045.44	6,383.06	11,950.78	8,509.46
61	4,253.33	2,652.41	10,303.14	10,488.05	5,969.40	11,292.28	8,086.37
62	4,093.65	2,640.05	9,844.38	9,927.69	5,643.80	10,635.94	7,667.71
<b>IRR</b>	11.4%	3.8%	15.2%	19.6%	18.8%	22.9%	12.3%

**Table A-4: The different wages for female between high school level and bachelor by field of study**

Age	Bachelor in Education and high school	Bachelor in Humanities and High school	Bachelor in Social science and High school	Bachelor in Commerce and High school	Bachelor in Pure Science and High school	Bachelor in Engineerin g and High school	Bachelor in Health Science and High school
Cost	-122,444.65	-122,444.65	-122,444.65	-122,444.65	-122,444.65	-155,272.65	-417,896.65
22	7,545.57	6,415.02	8,313.65	12,560.09	9,580.60	17,493.77	10,893.99
23	8,101.73	6,837.61	8,870.63	13,217.18	10,207.83	17,853.58	11,609.78
24	8,671.13	7,264.55	9,435.19	13,864.99	10,842.35	18,151.91	12,334.54
25	9,251.00	7,693.26	10,004.16	14,498.77	11,480.53	18,384.17	13,064.21
26	9,838.27	8,120.98	10,574.11	15,113.62	12,118.48	18,546.26	13,794.45
27	10,429.59	8,544.79	11,141.41	15,704.61	12,752.09	18,634.67	14,520.64
28	11,021.40	8,961.65	11,702.24	16,266.80	13,377.07	18,646.53	15,237.95
29	11,609.90	9,368.42	12,252.62	16,795.29	13,988.95	18,579.67	15,941.38
30	12,191.12	9,761.91	12,788.51	17,285.34	14,583.22	18,432.69	16,625.82
31	12,760.97	10,138.89	13,305.77	17,732.38	15,155.27	18,204.97	17,286.09
32	13,315.24	10,496.17	13,800.30	18,132.11	15,700.55	17,896.73	17,917.02
33	13,849.71	10,830.63	14,268.01	18,480.53	16,214.56	17,509.03	18,513.51
34	14,360.16	11,139.21	14,704.93	18,774.05	16,692.92	17,043.75	19,070.58
35	14,842.42	11,419.06	15,107.24	19,009.50	17,131.46	16,503.64	19,583.48
36	15,292.46	11,667.47	15,471.35	19,184.22	17,526.25	15,892.23	20,047.70
37	15,706.42	11,881.99	15,793.90	19,296.06	17,873.66	15,213.84	20,459.08
38	16,080.67	12,060.44	16,071.86	19,343.47	18,170.44	14,473.50	20,813.84
39	16,411.84	12,200.93	16,302.54	19,325.48	18,413.72	13,676.89	21,108.66
40	16,696.92	12,301.91	16,483.67	19,241.76	18,601.11	12,830.30	21,340.71
41	16,933.25	12,362.20	16,613.40	19,092.62	18,730.69	11,940.51	21,507.71
42	17,118.59	12,381.00	16,690.35	18,878.98	18,801.07	11,014.70	21,607.95
43	17,251.17	12,357.90	16,713.62	18,602.40	18,811.41	10,060.38	21,640.33
44	17,329.66	12,292.89	16,682.81	18,265.06	18,761.41	9,085.28	21,604.38
45	17,353.27	12,186.40	16,598.04	17,869.71	18,651.37	8,097.23	21,500.25
46	17,321.68	12,039.24	16,459.95	17,419.62	18,482.11	7,104.05	21,328.75
47	17,235.12	11,852.62	16,269.66	16,918.60	18,255.06	6,113.50	21,091.28
48	17,094.31	11,628.11	16,028.80	16,370.86	17,972.13	5,133.10	20,789.89
49	16,900.50	11,367.68	15,739.44	15,781.03	17,635.77	4,170.12	20,427.15
50	16,655.39	11,073.59	15,404.11	15,154.03	17,248.90	3,231.40	20,006.22
51	16,361.18	10,748.40	15,025.73	14,495.05	16,814.86	2,323.37	19,530.72
52	16,020.48	10,394.94	14,607.57	13,809.45	16,337.36	1,451.89	19,004.73
53	15,636.28	10,016.25	14,153.21	13,102.70	15,820.48	622.24	18,432.70
54	15,211.94	9,615.54	13,666.51	12,380.31	15,268.53	-160.93	17,819.42
55	14,751.10	9,196.16	13,151.50	11,647.73	14,686.06	-893.66	17,169.90
56	14,257.65	8,761.52	12,612.39	10,910.34	14,077.75	-1,572.70	16,489.38
57	13,735.69	8,315.10	12,053.46	10,173.33	13,448.38	-2,195.49	15,783.18
58	13,189.43	7,860.35	11,479.04	9,441.66	12,802.75	-2,760.20	15,056.68
59	12,623.17	7,400.65	10,893.43	8,720.02	12,145.63	-3,265.72	14,315.26
60	12,041.25	6,939.33	10,300.87	8,012.76	11,481.70	-3,711.61	13,564.20
61	11,447.96	6,479.54	9,705.47	7,323.87	10,815.48	-4,098.07	12,808.62
62	10,847.51	6,024.30	9,111.17	6,656.93	10,151.32	-4,425.96	12,053.45
IRR	9.5%	7.3%	9.8%	12.7%	11.0%	10.0%	2.8%

**Table A-4 continued: The different wages for female between high school level and bachelor by field of study**

<b>Age</b>	<b>Bachelor in Education and high school</b>	<b>Bachelor in Humanities and High school</b>	<b>Bachelor in Social science and High school</b>	<b>Bachelor in Commerce and High school</b>	<b>Bachelor in Pure Science and High school</b>	<b>Bachelor in Engineerin g and High school</b>	<b>Bachelor in Health Science and High school</b>
<b>cost</b>	-40,784.56	-42,892.56	-44,016.56	-42,556.56	-42,516.56	-43,624.56	-59,192.56
<b>22</b>	5,394.97	4,586.64	5,944.14	8,980.28	6,849.98	12,507.78	7,789.04
<b>23</b>	5,792.62	4,888.79	6,342.37	9,450.09	7,298.45	12,765.04	8,300.82
<b>24</b>	6,199.73	5,194.05	6,746.02	9,913.26	7,752.12	12,951.54	8,819.01
<b>25</b>	6,614.33	5,500.57	7,152.82	10,366.40	8,208.41	13,013.83	9,340.72
<b>26</b>	7,034.21	5,806.38	7,560.33	10,806.01	8,664.53	13,032.48	9,862.82
<b>27</b>	7,457.00	6,109.39	7,965.94	11,223.95	9,117.56	13,005.75	10,382.04
<b>28</b>	7,880.14	6,407.44	8,366.92	11,485.16	9,564.40	12,932.30	10,859.51
<b>29</b>	8,300.91	6,698.28	8,760.44	11,726.14	10,001.89	12,811.24	11,206.87
<b>30</b>	8,716.47	6,979.62	9,143.59	11,944.44	10,301.26	12,642.16	11,543.38
<b>31</b>	9,114.60	7,249.15	9,445.90	12,137.77	10,570.60	12,425.16	11,866.38
<b>32</b>	9,374.79	7,504.61	9,669.76	12,303.97	10,825.32	12,160.84	12,173.18
<b>33</b>	9,625.07	7,743.73	9,879.44	12,441.12	11,063.16	11,850.34	12,461.17
<b>34</b>	9,863.37	7,904.68	10,073.02	12,570.80	11,281.94	11,495.29	12,762.68
<b>35</b>	10,087.63	8,005.85	10,248.67	12,681.22	11,479.62	11,097.83	13,066.42
<b>36</b>	10,295.88	8,091.49	10,404.66	12,771.61	11,677.95	10,660.61	13,351.10
<b>37</b>	10,486.23	8,160.56	10,539.43	12,821.47	11,866.89	10,186.69	13,601.98
<b>38</b>	10,667.39	8,212.18	10,661.69	12,829.93	12,042.70	9,679.58	13,816.71
<b>39</b>	10,848.68	8,245.62	10,777.95	12,796.52	12,184.63	9,143.17	13,993.23
<b>40</b>	11,013.29	8,260.33	10,870.18	12,721.16	12,291.22	8,581.65	14,129.79
<b>41</b>	11,155.04	8,255.94	10,940.39	12,604.22	12,361.32	7,999.50	14,225.01
<b>42</b>	11,265.02	8,232.28	10,977.62	12,446.43	12,394.15	7,401.42	14,277.87
<b>43</b>	11,342.15	8,189.37	10,981.39	12,248.97	12,389.24	6,792.23	14,287.76
<b>44</b>	11,385.63	8,127.44	10,951.52	12,013.39	12,346.49	6,176.86	14,254.43
<b>45</b>	11,395.00	8,046.92	10,888.16	11,741.58	12,266.16	5,560.25	14,178.08
<b>46</b>	11,370.10	7,948.42	10,791.79	11,435.83	12,148.88	4,947.28	14,059.28
<b>47</b>	11,311.12	7,832.76	10,663.19	11,098.70	11,995.61	4,342.74	13,899.03
<b>48</b>	11,218.54	7,700.91	10,503.46	10,733.02	11,807.65	3,670.09	13,698.68
<b>49</b>	11,093.18	7,554.02	10,313.99	10,341.90	11,586.64	2,981.57	13,459.96
<b>50</b>	10,936.16	7,393.39	10,096.42	9,928.88	11,334.48	2,310.40	13,184.94
<b>51</b>	10,748.89	7,220.42	9,861.59	9,518.18	11,053.36	1,661.17	12,876.00
<b>52</b>	10,533.03	7,036.64	9,610.79	9,113.04	10,745.70	1,038.08	12,535.80
<b>53</b>	10,300.17	6,843.66	9,359.39	8,720.56	10,419.37	444.89	12,167.22
<b>54</b>	10,052.98	6,643.14	9,106.58	8,324.42	10,089.60	-115.06	11,773.35
<b>55</b>	9,814.80	6,436.78	8,842.07	7,927.61	9,775.25	-638.96	11,357.44
<b>56</b>	9,568.56	6,226.31	8,568.06	7,533.03	9,459.16	-1,124.45	10,944.72
<b>57</b>	9,309.73	5,945.17	8,286.75	7,143.42	9,135.01	-1,569.74	10,554.83
<b>58</b>	9,040.45	5,620.03	8,000.35	6,750.64	8,805.31	-1,973.50	10,175.95
<b>59</b>	8,762.89	5,291.36	7,711.02	6,234.68	8,472.49	-2,334.94	9,791.87
<b>60</b>	8,479.21	4,961.51	7,364.96	5,729.00	8,138.95	-2,653.74	9,405.34
<b>61</b>	8,185.12	4,632.77	6,939.26	5,236.45	7,732.91	-2,930.06	9,018.99
<b>62</b>	7,755.81	4,307.28	6,514.35	4,759.61	7,258.04	-3,164.49	8,618.04
<b>IRR</b>	18.1%	14.4%	17.7%	24.5%	20.5%	29.0%	17.2%

**Table A-5: the different total and after-tax wages between Bachelor and High school for male**

age	wage bachelor	Net wage bachelor	wage_hs	Net wage_hs	difference	difference after tax
Cost					-149,175.00	-51,637.00
22	23,771.73	17,132.93	15,201.65	11,005.45	8,570.08	6,127.48
23	25,608.44	18,446.15	16,339.25	11,818.82	9,269.20	6,627.34
24	27,498.77	19,797.71	17,509.78	12,655.73	9,988.99	7,141.98
25	29,434.11	21,181.45	18,708.38	13,512.71	10,725.73	7,668.73
26	31,404.80	22,440.75	19,929.61	14,385.88	11,475.19	8,054.88
27	33,400.18	23,654.16	21,167.46	15,270.92	12,232.72	8,383.24
28	35,408.63	24,875.52	22,415.36	16,163.15	12,993.27	8,712.37
29	37,417.69	26,097.25	23,666.27	17,057.53	13,751.42	9,039.72
30	39,414.17	27,392.02	24,912.71	17,948.71	14,501.46	9,443.31
31	41,384.27	28,714.18	26,146.84	18,831.10	15,237.43	9,883.08
32	43,313.76	30,009.08	27,360.54	19,698.88	15,953.22	10,310.20
33	45,188.09	31,266.96	28,545.47	20,546.09	16,642.62	10,720.87
34	46,992.62	32,477.99	29,693.19	21,366.69	17,299.42	11,111.31
35	48,712.77	33,632.41	30,795.25	22,070.07	17,917.53	11,562.33
36	50,334.25	34,720.60	31,843.26	22,707.38	18,490.99	12,013.21
37	51,843.22	35,733.28	32,829.07	23,306.86	19,014.15	12,426.42
38	53,226.50	36,661.61	33,744.79	23,863.72	19,481.71	12,797.89
39	54,471.75	37,497.31	34,582.94	24,373.41	19,888.81	13,123.90
40	55,567.69	38,232.81	35,336.57	24,831.70	20,231.13	13,401.12
41	56,504.23	38,861.33	35,999.28	25,234.70	20,504.95	13,626.63
42	57,272.62	39,377.01	36,565.41	25,578.97	20,707.22	13,798.04
43	57,865.64	39,774.99	37,030.04	25,861.51	20,835.61	13,913.48
44	58,277.65	40,051.49	37,389.10	26,079.86	20,888.56	13,971.63
45	58,504.71	40,203.88	37,639.42	26,233.62	20,865.29	13,970.25
46	58,544.65	40,230.68	37,778.78	26,323.81	20,765.87	13,906.87
47	58,397.09	40,131.65	37,805.95	26,341.39	20,591.14	13,790.26
48	58,063.43	39,907.72	37,720.67	26,286.20	20,342.75	13,621.52
49	57,546.87	39,561.06	37,523.72	26,161.73	20,023.16	13,399.33
50	56,852.34	39,094.95	37,216.83	25,975.11	19,635.51	13,119.85
51	55,986.40	38,513.81	36,802.73	25,723.29	19,183.67	12,790.52
52	54,957.16	37,823.08	36,285.06	25,408.48	18,672.10	12,414.59
53	53,774.15	37,029.15	35,668.32	25,033.44	18,105.83	11,995.71
54	52,448.18	36,139.28	34,957.85	24,601.40	17,490.33	11,537.88
55	50,991.16	35,161.45	34,159.68	24,116.02	16,831.47	11,045.43
56	49,415.92	34,104.29	33,280.52	23,581.39	16,135.40	10,522.90
57	47,736.04	32,976.91	32,327.60	23,001.91	15,408.44	9,975.00
58	45,965.66	31,788.79	31,308.62	22,382.26	14,657.04	9,406.53
59	44,119.25	30,549.65	30,231.62	21,727.33	13,887.63	8,822.32
60	42,211.46	29,269.31	29,104.91	20,946.07	13,106.55	8,323.24
61	40,256.88	27,957.57	27,936.89	20,110.96	12,320.00	7,846.62
62	38,269.91	26,641.62	26,736.03	19,252.36	11,533.88	7,389.26
IRR					9.3%	16.5%

**Table A-6: the difference in total and after-tax wages between Bachelor and High school for female**

age	wage bachelor	Net wage bachelor	wage_hs	Net wage_hs	difference	difference after tax
Cost					-136,889	-40,785
22	19,776.47	14,276.38	10,665.09	7,761.88	9,111.38	6,514.50
23	21,062.82	15,196.10	11,376.34	8,270.41	9,686.47	6,925.68
24	22,369.13	16,130.09	12,102.85	8,789.86	10,266.27	7,340.23
25	23,689.00	17,073.78	12,841.62	9,318.07	10,847.38	7,755.71
26	25,015.51	18,022.22	13,589.36	9,852.69	11,426.16	8,169.53
27	26,341.30	18,970.13	14,342.51	10,391.18	11,998.79	8,578.96
28	27,658.59	19,911.98	15,097.26	10,930.81	12,561.33	8,981.16
29	28,959.29	20,841.96	15,849.59	11,468.72	13,109.70	9,373.24
30	30,235.06	21,729.42	16,595.30	12,001.89	13,639.76	9,727.53
31	31,477.40	22,484.90	17,330.03	12,527.21	14,147.37	9,957.69
32	32,677.73	23,214.83	18,049.30	13,041.48	14,628.44	10,173.36
33	33,827.51	23,914.03	18,748.58	13,541.45	15,078.93	10,372.57
34	34,918.31	24,577.35	19,423.32	14,023.88	15,494.99	10,553.47
35	35,941.93	25,199.83	20,068.99	14,485.52	15,872.95	10,714.30
36	36,890.52	25,776.67	20,681.14	14,923.20	16,209.38	10,853.47
37	37,756.62	26,309.46	21,255.46	15,333.83	16,501.16	10,975.63
38	38,533.32	26,812.08	21,787.80	15,714.45	16,745.52	11,097.62
39	39,214.34	27,257.91	22,274.27	16,062.27	16,940.07	11,195.65
40	39,794.08	27,646.98	22,711.22	16,374.68	17,082.86	11,272.30
41	40,267.72	27,964.84	23,095.35	16,649.33	17,172.37	11,315.52
42	40,631.29	28,208.84	23,423.70	16,884.09	17,207.59	11,324.75
43	40,881.73	28,376.92	23,693.73	17,077.16	17,188.00	11,299.76
44	41,016.92	28,467.64	23,903.33	17,227.02	17,113.59	11,240.62
45	41,035.70	28,480.24	24,050.85	17,332.49	16,984.85	11,147.75
46	40,937.91	28,414.62	24,135.11	17,392.74	16,802.80	11,021.87
47	40,724.39	28,271.32	24,155.46	17,407.29	16,568.93	10,864.03
48	40,396.95	28,051.57	24,111.72	17,376.02	16,285.22	10,675.55
49	39,958.35	27,757.23	24,004.25	17,299.18	15,954.10	10,458.05
50	39,412.29	27,390.76	23,833.90	17,177.38	15,578.38	10,213.37
51	38,763.30	26,960.90	23,602.01	17,011.59	15,161.29	9,949.31
52	38,016.74	26,477.79	23,310.41	16,803.10	14,706.33	9,674.70
53	37,178.70	25,951.92	22,961.38	16,553.54	14,217.32	9,398.38
54	36,255.88	25,390.74	22,557.60	16,264.84	13,698.29	9,125.90
55	35,255.58	24,782.45	22,102.16	15,939.21	13,153.42	8,843.23
56	34,185.52	24,131.74	21,598.50	15,579.10	12,587.02	8,552.63
57	33,053.82	23,443.54	21,050.36	15,187.19	12,003.46	8,256.35
58	31,868.84	22,722.94	20,461.73	14,766.33	11,407.10	7,956.60
59	30,639.09	21,975.11	19,836.83	14,319.54	10,802.25	7,655.58
60	29,373.14	21,137.86	19,180.03	13,849.93	10,193.12	7,287.93
61	28,079.55	20,212.96	18,495.80	13,360.72	9,583.75	6,852.24
62	26,766.70	19,274.29	17,788.69	12,855.14	8,978.01	6,419.15
IRR					9.3%	20.2%

**Table A-7: the difference in total and after-tax wages between Bachelor and Master for male**

age	Wage bachelor	Net wage bachelor	Wage master	Net wage master	difference	Difference after tax
Cost					-113,570.11	-50,624.46
24	27,498.77	19,797.71	26,944.98	19,401.76	-553.79	-395.95
25	29,434.11	21,181.45	29,072.44	20,922.86	-361.67	-258.59
26	31,404.80	22,440.75	31,258.90	22,352.03	-145.90	-88.73
27	33,400.18	23,654.16	33,493.02	23,710.62	92.84	56.46
28	35,408.63	24,875.52	35,762.15	25,090.50	353.52	214.98
29	37,417.69	26,097.25	38,052.34	26,500.83	634.66	403.58
30	39,414.17	27,392.02	40,348.54	28,019.08	934.37	627.06
31	41,384.27	28,714.18	42,634.65	29,553.32	1,250.38	839.14
32	43,313.76	30,009.08	44,893.78	31,069.44	1,580.02	1,060.37
33	45,188.09	31,266.96	47,108.38	32,555.69	1,920.29	1,288.73
34	46,992.62	32,477.99	49,260.50	33,999.99	2,267.88	1,522.00
35	48,712.77	33,632.41	51,331.97	35,390.18	2,619.20	1,757.77
36	50,334.25	34,720.60	53,304.71	36,714.10	2,970.46	1,993.50
37	51,843.22	35,733.28	55,160.97	37,959.85	3,317.74	2,226.57
38	53,226.50	36,661.61	56,883.55	39,115.89	3,657.05	2,454.28
39	54,471.75	37,497.31	58,456.12	40,171.27	3,984.37	2,673.95
40	55,567.69	38,232.81	59,863.47	41,115.75	4,295.78	2,882.94
41	56,504.23	38,861.33	61,091.72	41,883.06	4,587.50	3,021.73
42	57,272.62	39,377.01	62,128.58	42,524.33	4,855.95	3,147.32
43	57,865.64	39,774.99	62,963.52	43,040.73	5,097.87	3,265.74
44	58,277.65	40,051.49	63,587.99	43,426.95	5,310.34	3,375.46
45	58,504.71	40,203.88	63,995.55	43,679.02	5,490.84	3,475.14
46	58,544.65	40,230.68	64,181.96	43,794.31	5,637.31	3,563.63
47	58,397.09	40,131.65	64,145.29	43,771.63	5,748.21	3,639.99
48	58,063.43	39,907.72	63,885.92	43,611.21	5,822.49	3,703.49
49	57,546.87	39,561.06	63,406.54	43,314.73	5,859.66	3,753.67
50	56,852.34	39,094.95	62,712.12	42,885.24	5,859.78	3,790.29
51	55,986.40	38,513.81	61,809.82	42,327.19	5,823.42	3,813.38
52	54,957.16	37,823.08	60,708.85	41,646.26	5,751.69	3,823.19
53	53,774.15	37,029.15	59,420.34	40,818.36	5,646.19	3,789.21
54	52,448.18	36,139.28	57,957.12	39,836.38	5,508.94	3,697.11
55	50,991.16	35,161.45	56,333.54	38,746.78	5,342.38	3,585.33
56	49,415.92	34,104.29	54,565.21	37,560.03	5,149.29	3,455.74
57	47,736.04	32,976.91	52,668.77	36,287.31	4,932.73	3,310.40
58	45,965.66	31,788.79	50,661.61	34,940.29	4,695.96	3,151.50
59	44,119.25	30,549.65	48,561.65	33,530.99	4,442.40	2,981.34
60	42,211.46	29,269.31	46,387.02	32,071.57	4,175.56	2,802.26
61	40,256.88	27,957.57	44,155.83	30,574.19	3,898.94	2,616.62
62	38,269.91	26,641.62	41,885.92	29,050.84	3,616.01	2,409.22
IRR					0.9%	2.6%

**Table A-8: the difference in total and after-tax wages between Bachelor and Master for female**

age	wage bachelor	Net wage bachelor	Wage master	Net wage master	difference	Difference after tax
Cost					-107,876.19	-45,595.02
24	22,369.13	16,130.09	26,584.76	19,144.20	4,215.63	3,014.11
25	23,689.00	17,073.78	27,921.55	20,099.99	4,232.55	3,026.21
26	25,015.51	18,022.22	29,260.11	21,057.04	4,244.60	3,034.82
27	26,341.30	18,970.13	30,594.42	21,947.95	4,253.12	2,977.82
28	27,658.59	19,911.98	31,918.19	22,752.95	4,259.60	2,840.97
29	28,959.29	20,841.96	33,224.94	23,547.59	4,265.65	2,705.64
30	30,235.06	21,729.42	34,508.00	24,327.84	4,272.94	2,598.42
31	31,477.40	22,484.90	35,760.64	25,089.58	4,283.24	2,604.68
32	32,677.73	23,214.83	36,976.05	25,828.68	4,298.32	2,613.85
33	33,827.51	23,914.03	38,147.46	26,562.38	4,319.95	2,648.35
34	34,918.31	24,577.35	39,268.15	27,294.02	4,349.84	2,716.67
35	35,941.93	25,199.83	40,331.56	28,007.69	4,389.63	2,807.87
36	36,890.52	25,776.67	41,331.34	28,678.65	4,440.82	2,901.98
37	37,756.62	26,309.46	42,261.38	29,302.81	4,504.76	2,993.35
38	38,533.32	26,812.08	43,115.92	29,876.30	4,582.60	3,064.23
39	39,214.34	27,257.91	43,889.58	30,395.52	4,675.24	3,137.60
40	39,794.08	27,646.98	44,577.43	30,857.14	4,783.36	3,210.16
41	40,267.72	27,964.84	45,175.03	31,258.19	4,907.31	3,293.35
42	40,631.29	28,208.84	45,678.48	31,596.06	5,047.19	3,387.22
43	40,881.73	28,376.92	46,084.47	31,868.52	5,202.73	3,491.61
44	41,016.92	28,467.64	46,390.31	32,073.78	5,373.40	3,606.14
45	41,035.70	28,480.24	46,593.99	32,210.47	5,558.29	3,730.22
46	40,937.91	28,414.62	46,694.12	32,277.67	5,756.21	3,863.05
47	40,724.39	28,271.32	46,690.05	32,274.94	5,965.66	4,003.62
48	40,396.95	28,051.57	46,581.80	32,202.29	6,184.85	4,150.72
49	39,958.35	27,757.23	46,370.09	32,060.21	6,411.74	4,302.99
50	39,412.29	27,390.76	46,056.35	31,849.65	6,644.06	4,458.90
51	38,763.30	26,960.90	45,642.64	31,572.01	6,879.34	4,611.12
52	38,016.74	26,477.79	45,131.72	31,229.13	7,114.98	4,751.33
53	37,178.70	25,951.92	44,526.93	30,823.25	7,348.23	4,871.33
54	36,255.88	25,390.74	43,832.22	30,357.02	7,576.34	4,966.28
55	35,255.58	24,782.45	43,052.06	29,833.44	7,796.48	5,051.00
56	34,185.52	24,131.74	42,191.42	29,255.86	8,005.90	5,124.13
57	33,053.82	23,443.54	41,255.73	28,627.91	8,201.90	5,184.37
58	31,868.84	22,722.94	40,250.76	27,953.47	8,381.92	5,230.53
59	30,639.09	21,975.11	39,182.64	27,236.64	8,543.56	5,261.53
60	29,373.14	21,137.86	38,057.75	26,504.33	8,684.61	5,366.47
61	28,079.55	20,212.96	36,882.67	25,771.90	8,803.12	5,558.94
62	26,766.70	19,274.29	35,664.11	25,030.88	8,897.41	5,756.59
IRR					3.7%	6.5%

**Table A-9: the difference in total and after-tax wages between PhD and Master for male**

age	wage PhD	Net wage PhD	wage master	Net wage master	difference	difference after tax
cost					-474,448.90	-93,613.37
28	28,728.60	20,677.02	35,762.15	25,090.50	-7,033.55	-4,413.48
29	30,748.18	22,041.45	38,052.34	26,500.83	-7,304.16	-4,459.38
30	32,823.93	23,303.74	40,348.54	28,019.08	-7,524.60	-4,715.34
31	34,948.46	24,595.68	42,634.65	29,553.32	-7,686.20	-4,957.64
32	37,113.47	25,912.25	44,893.78	31,069.44	-7,780.31	-5,157.19
33	39,309.84	27,322.00	47,108.38	32,555.69	-7,798.54	-5,233.68
34	41,527.64	28,810.39	49,260.50	33,999.99	-7,732.86	-5,189.60
35	43,756.17	30,305.98	51,331.97	35,390.18	-7,575.80	-5,084.19
36	45,984.09	31,801.16	53,304.71	36,714.10	-7,320.62	-4,912.94
37	48,199.45	33,287.91	55,160.97	37,959.85	-6,961.51	-4,671.94
38	50,389.82	34,757.89	56,883.55	39,115.89	-6,493.73	-4,358.01
39	52,542.37	36,202.48	58,456.12	40,171.27	-5,913.76	-3,968.78
40	54,644.02	37,612.93	59,863.47	41,115.75	-5,219.45	-3,502.83
41	56,681.57	38,980.35	61,091.72	41,883.06	-4,410.15	-2,902.71
42	58,641.80	40,295.88	62,128.58	42,524.33	-3,486.77	-2,228.46
43	60,511.64	41,524.29	62,963.52	43,040.73	-2,451.88	-1,516.44
44	62,278.29	42,616.93	63,587.99	43,426.95	-1,309.70	-810.02
45	63,929.40	43,638.11	63,995.55	43,679.02	-66.15	-40.91
46	65,453.19	44,580.54	64,181.96	43,794.31	1,271.22	786.23
47	66,838.57	45,437.37	64,145.29	43,771.63	2,693.28	1,665.74
48	68,075.32	46,202.27	63,885.92	43,611.21	4,189.40	2,591.06
49	69,154.17	46,869.52	63,406.54	43,314.73	5,747.64	3,554.80
50	70,066.96	47,434.07	62,712.12	42,885.24	7,354.84	4,548.82
51	70,806.70	47,891.58	61,809.82	42,327.19	8,996.88	5,564.39
52	71,367.69	48,238.54	60,708.85	41,646.26	10,658.84	6,592.28
53	71,745.57	48,472.25	59,420.34	40,818.36	12,325.23	7,653.89
54	71,937.40	48,590.89	57,957.12	39,836.38	13,980.28	8,754.51
55	71,941.68	48,593.54	56,333.54	38,746.78	15,608.14	9,846.76
56	71,758.37	48,480.17	54,565.21	37,560.03	17,193.16	10,920.14
57	71,388.92	48,251.67	52,668.77	36,287.31	18,720.15	11,964.35
58	70,836.19	47,909.82	50,661.61	34,940.29	20,174.57	12,969.52
59	70,104.47	47,457.27	48,561.65	33,530.99	21,542.82	13,926.28
60	69,199.43	46,897.51	46,387.02	32,071.57	22,812.41	14,825.94
61	68,127.97	46,234.84	44,155.83	30,574.19	23,972.14	15,660.64
62	66,898.22	45,474.26	41,885.92	29,050.84	25,012.30	16,423.42
IRR					-3.2%	-0.3%

**Table A-10: the different total and after-tax wages between PhD and Master for female**

age	wage	Net wage	Wage master	Net wage master	difference	Difference after tax
Cost					-470,176.56	-93,148.24
28	31,426.43	22,453.91	31,918.19	22,752.95	-491.76	-299.05
29	32,781.02	23,277.65	33,224.94	23,547.59	-443.91	-269.95
30	34,138.96	24,103.42	34,508.00	24,327.84	-369.04	-224.42
31	35,495.92	24,928.60	35,760.64	25,089.58	-264.72	-160.98
32	36,847.40	25,750.45	36,976.05	25,828.68	-128.66	-78.24
33	38,188.76	26,589.11	38,147.46	26,562.38	41.30	26.73
34	39,515.24	27,459.85	39,268.15	27,294.02	247.09	165.83
35	40,821.97	28,336.81	40,331.56	28,007.69	490.41	329.12
36	42,104.03	29,197.21	41,331.34	28,678.65	772.69	518.56
37	43,356.45	30,037.72	42,261.38	29,302.81	1,095.07	734.91
38	44,574.25	30,855.00	43,115.92	29,876.30	1,458.33	978.70
39	45,752.49	31,645.73	43,889.58	30,395.52	1,862.90	1,250.21
40	46,886.27	32,406.62	44,577.43	30,857.14	2,308.84	1,549.49
41	47,970.81	33,134.46	45,175.03	31,258.19	2,795.78	1,876.27
42	49,001.42	33,826.12	45,678.48	31,596.06	3,322.94	2,230.06
43	49,973.59	34,478.56	46,084.47	31,868.52	3,889.13	2,610.03
44	50,883.02	35,088.88	46,390.31	32,073.78	4,492.70	3,015.10
45	51,725.59	35,654.34	46,593.99	32,210.47	5,131.60	3,443.87
46	52,497.47	36,172.35	46,694.12	32,277.67	5,803.35	3,894.68
47	53,195.10	36,640.54	46,690.05	32,274.94	6,505.05	4,365.60
48	53,815.22	37,056.71	46,581.80	32,202.29	7,233.42	4,854.42
49	54,354.94	37,418.92	46,370.09	32,060.21	7,984.85	5,358.71
50	54,811.69	37,725.45	46,056.35	31,849.65	8,755.35	5,875.80
51	55,183.31	37,974.85	45,642.64	31,572.01	9,540.66	6,402.84
52	55,468.01	38,165.91	45,131.72	31,229.13	10,336.29	6,936.79
53	55,664.43	38,297.73	44,526.93	30,823.25	11,137.49	7,474.48
54	55,771.61	38,369.67	43,832.22	30,357.02	11,939.40	8,012.65
55	55,789.06	38,381.37	43,052.06	29,833.44	12,737.00	8,547.93
56	55,716.67	38,332.79	42,191.42	29,255.86	13,525.24	9,076.93
57	55,554.80	38,224.16	41,255.73	28,627.91	14,299.07	9,596.25
58	55,304.23	38,056.00	40,250.76	27,953.47	15,053.47	10,102.53
59	54,966.17	37,829.12	39,182.64	27,236.64	15,783.52	10,592.48
60	54,542.22	37,544.61	38,057.75	26,504.33	16,484.47	11,040.28
61	54,034.43	37,203.82	36,882.67	25,771.90	17,151.76	11,431.92
62	53,445.19	36,808.38	35,664.11	25,030.88	17,781.08	11,777.50
IRR					-2.6%	1.9%

**Table A-11 The difference in female wages between bachelor by field of study and high school in 1990**

Age	Education	Humanities	Social science	commerce	pure science	Engineering	Health
22	5,417.27	3,865.59	5,262.53	8,713.94	7,315.16	13,540.69	9,516.50
23	5,720.79	4,037.10	5,576.23	9,074.72	7,547.99	13,735.54	9,871.09
24	6,027.83	4,206.91	5,895.24	9,429.47	7,770.10	13,896.84	10,215.87
25	6,337.20	4,374.19	6,218.38	9,776.36	7,980.08	14,023.06	10,548.91
26	6,647.59	4,538.09	6,544.37	10,113.52	8,176.59	14,112.93	10,868.29
27	6,957.64	4,697.74	6,871.86	10,439.10	8,358.35	14,165.42	11,172.15
28	7,265.92	4,852.27	7,199.42	10,751.25	8,524.13	14,179.78	11,458.63
29	7,570.96	5,000.82	7,525.53	11,048.16	8,672.79	14,155.53	11,725.99
30	7,871.22	5,142.55	7,848.63	11,328.07	8,803.31	14,092.48	11,972.55
31	8,165.17	5,276.62	8,167.11	11,589.30	8,914.75	13,990.75	12,196.73
32	8,451.23	5,402.23	8,479.33	11,830.23	9,006.31	13,850.73	12,397.08
33	8,727.83	5,518.63	8,783.60	12,049.36	9,077.30	13,673.12	12,572.29
34	8,993.41	5,625.09	9,078.26	12,245.30	9,127.20	13,458.91	12,721.20
35	9,246.45	5,720.95	9,361.64	12,416.80	9,155.60	13,209.38	12,842.81
36	9,485.45	5,805.60	9,632.11	12,562.73	9,162.25	12,926.05	12,936.28
37	9,708.96	5,878.49	9,888.05	12,682.16	9,147.07	12,610.71	13,000.98
38	9,915.63	5,939.16	10,127.92	12,774.28	9,110.11	12,265.39	13,036.46
39	10,104.17	5,987.21	10,350.26	12,838.49	9,051.58	11,892.32	13,042.46
40	10,273.39	6,022.32	10,553.66	12,874.35	8,971.85	11,493.92	13,018.92
41	10,422.20	6,044.27	10,736.84	12,881.63	8,871.43	11,072.77	12,965.99
42	10,549.66	6,052.89	10,898.63	12,860.27	8,750.99	10,631.60	12,884.01
43	10,654.93	6,048.15	11,037.98	12,810.41	8,611.31	10,173.22	12,773.53
44	10,737.32	6,030.07	11,153.98	12,732.39	8,453.31	9,700.53	12,635.27
45	10,796.29	5,998.77	11,245.86	12,626.70	8,278.03	9,216.47	12,470.13
46	10,831.45	5,954.45	11,313.04	12,494.06	8,086.60	8,723.98	12,279.21
47	10,842.57	5,897.41	11,355.05	12,335.32	7,880.27	8,226.02	12,063.73
48	10,829.58	5,828.02	11,371.63	12,151.52	7,660.34	7,725.47	11,825.08
49	10,792.57	5,746.72	11,362.68	11,943.83	7,428.19	7,225.14	11,564.78
50	10,731.79	5,654.04	11,328.26	11,713.57	7,185.26	6,727.77	11,284.46
51	10,647.65	5,550.58	11,268.60	11,462.20	6,933.01	6,235.94	10,985.86
52	10,540.69	5,436.97	11,184.13	11,191.27	6,672.93	5,752.11	10,670.77
53	10,411.63	5,313.92	11,075.40	10,902.43	6,406.53	5,278.56	10,341.07
54	10,261.31	5,182.19	10,943.14	10,597.40	6,135.28	4,817.40	9,998.68
55	10,090.71	5,042.56	10,788.24	10,277.98	5,860.67	4,370.54	9,645.54
56	9,900.90	4,895.85	10,611.71	9,945.99	5,584.13	3,939.70	9,283.60
57	9,693.10	4,742.91	10,414.69	9,603.30	5,307.04	3,526.35	8,914.80
58	9,468.59	4,584.60	10,198.44	9,251.77	5,030.76	3,131.79	8,541.05
59	9,228.74	4,421.79	9,964.33	8,893.26	4,756.54	2,757.07	8,164.21
60	8,975.01	4,255.33	9,713.80	8,529.59	4,485.58	2,403.02	7,786.10
61	8,708.89	4,086.10	9,448.39	8,162.57	4,218.99	2,070.28	7,408.45
62	8,431.90	3,914.92	9,169.67	7,793.94	3,957.80	1,759.25	7,032.92

Source: the Vaillancourt and Bourdeau-Primeau (2002) regression results in their Table A-3 and Table A-5, page 232 and 234,

**Table A-12 The difference in female wages between bachelor by field of study and high school in 1995**

	Education	Humanities	Social science	commerce	pure science	Engineering	Health
22	7,256.60	5,552.00	6,860.11	9,823.96	8,947.62	11,238.67	11,437.64
23	7,687.72	5,830.48	7,279.49	10,356.35	9,391.25	11,559.85	12,062.59
24	8,117.91	6,101.13	7,699.50	10,881.48	9,823.06	11,843.30	12,680.10
25	8,544.12	6,361.45	8,117.33	11,395.26	10,239.24	12,084.96	13,285.50
26	8,963.21	6,608.86	8,529.99	11,893.51	10,635.94	12,281.03	13,873.99
27	9,371.89	6,840.81	8,934.38	12,371.96	11,009.34	12,428.02	14,440.68
28	9,766.83	7,054.75	9,327.32	12,826.34	11,355.65	12,522.87	14,980.66
29	10,144.67	7,248.24	9,705.58	13,252.44	11,671.20	12,562.93	15,489.07
30	10,502.05	7,418.90	10,065.90	13,646.14	11,952.50	12,546.11	15,961.16
31	10,835.68	7,564.54	10,405.11	14,003.49	12,196.28	12,470.85	16,392.36
32	11,142.37	7,683.13	10,720.06	14,320.79	12,399.53	12,336.20	16,778.34
33	11,419.11	7,772.88	11,007.77	14,594.60	12,559.62	12,141.85	17,115.12
34	11,663.07	7,832.24	11,265.40	14,821.83	12,674.24	11,888.13	17,399.05
35	11,871.67	7,859.95	11,490.36	14,999.80	12,741.55	11,576.05	17,626.96
36	12,042.63	7,855.07	11,680.27	15,126.25	12,760.14	11,207.29	17,796.16
37	12,173.98	7,817.00	11,833.08	15,199.42	12,729.10	10,784.18	17,904.50
38	12,264.13	7,745.47	11,947.05	15,218.05	12,648.04	10,309.71	17,950.42
39	12,311.86	7,640.59	12,020.82	15,181.46	12,517.09	9,787.43	17,932.95
40	12,316.38	7,502.85	12,053.38	15,089.48	12,336.92	9,221.48	17,851.79
41	12,277.33	7,333.09	12,044.16	14,942.56	12,108.72	8,616.49	17,707.25
42	12,194.79	7,132.52	11,992.98	14,741.68	11,834.21	7,977.55	17,500.32
43	12,069.27	6,902.70	11,900.10	14,488.40	11,515.59	7,310.09	17,232.59
44	11,901.74	6,645.52	11,766.18	14,184.82	11,155.56	6,619.86	16,906.30
45	11,693.58	6,363.15	11,592.31	13,833.54	10,757.22	5,912.81	16,524.25
46	11,446.58	6,058.07	11,379.98	13,437.64	10,324.07	5,195.00	16,089.79
47	11,162.91	5,732.97	11,131.06	13,000.63	9,859.94	4,472.56	15,606.77
48	10,845.11	5,390.73	10,847.74	12,526.38	9,368.94	3,751.55	15,079.49
49	10,496.00	5,034.40	10,532.58	12,019.10	8,855.40	3,037.90	14,512.60
50	10,118.70	4,667.14	10,188.37	11,483.25	8,323.81	2,337.33	13,911.08
51	9,716.54	4,292.16	9,818.17	10,923.47	7,778.73	1,655.27	13,280.12
52	9,293.03	3,912.69	9,425.22	10,344.55	7,224.76	996.79	12,625.10
53	8,851.79	3,531.93	9,012.92	9,751.32	6,666.46	366.54	11,951.46
54	8,396.54	3,153.00	8,584.75	9,148.59	6,108.28	-231.31	11,264.66
55	7,930.99	2,778.91	8,144.24	8,541.12	5,554.51	-793.09	10,570.08
56	7,458.86	2,412.50	7,694.94	7,933.51	5,009.22	-1,315.70	9,872.99
57	6,983.74	2,056.42	7,240.32	7,330.19	4,476.22	-1,796.61	9,178.44
58	6,509.15	1,713.11	6,783.80	6,735.32	3,959.03	-2,233.86	8,491.22
59	6,038.40	1,384.74	6,328.63	6,152.78	3,460.80	-2,626.08	7,815.83
60	5,574.63	1,073.22	5,877.91	5,586.13	2,984.31	-2,972.50	7,156.39
61	5,120.73	780.17	5,434.53	5,038.55	2,531.98	-3,272.89	6,516.64
62	4,679.33	506.93	5,001.15	4,512.84	2,105.80	-3,527.55	5,899.90

Source: the Vaillancourt and Bourdeau-Primeau (2002) regression results in their Table A-4 and Table A-6, page 233 and 235,

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